A Report for

Arizona Public Safety Communications Commission (PSCC)

State of Arizona Statewide Wireless Public Safety Solution Concept of Operations

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220847450

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NOTE FROM EXECUTIVE DIRECTOR CURT KNIGHT:

It is critical we move forward and replace the existing public safety radio communications systems in Arizona. As our state continues to grow, the issue of radio interoperability will only get worse with each passing year as our aged infrastructure continues to fall behind the increased demand for services by the public safety provider.

The aging, existing statewide emergency radio communications system:

- Does not meet the emergency services expectations of the public in a post 9/11 world
- Will not integrate or interoperate with newly implemented emergency services providers throughout the state
- Is largely ineffective for cross-jurisdictional emergency communications, especially considering our upcoming participation in the federal 2007 TOPOFF 4 Homeland Security exercise
- Puts Arizona citizens and public safety personnel at increased risk of injury or death during critical situations

To remedy the situation, we need to develop standards for technology that are driven by the user to build a scalable, efficient and effective emergency service communication system that will capitalize on and complement the recent investments made by local political subdivisions to improve interoperability. This will occur while also filling tactical emergency services gaps in regions that have been historically deficient.

Attached is an executive summary and a diagram of the proposed "Concept of Operations" that reflects the PSCC recommendations for the manner in which the new emergency services communications systems should operate in the future. The path to interoperability requires diligent execution of numerous activities that encompass not only technology changes, but significant changes to operations, training, and collaboration among public safety agencies. With appropriate funding and dedicated support from the Governor and the Legislature, interoperability can be achieved over the next 8 years.

The PSCC has involved numerous stakeholders from the public safety and emergency services community to develop this Concept of Operations that, when implemented, will address the ongoing and changing public safety communications needs for all first responders in Arizona. We must collectively pursue this issue immediately to ensure optimal provision of public safety services to the citizens of Arizona.

Respectfully,

Curt Knight
Executive Director
Public Safety Communications Commission

Executive Summary

Problem and Call to Action

The State of Arizona is at a crossroads in its provisioning of public safety land mobile radio communications services. Although citizens depend on and value the critical assistance provided by public safety agencies, many are not aware of the extreme efforts public safety providers are forced to employ to simply communicate with each other to protect lives and property. Public safety agencies often have incompatible radio equipment and use different frequency bands for radio communications, rendering communications difficult, if not impossible. Adding to the issues are operational and procedural issues between and among public safety agencies that compound the significant technology challenges.

As a result of current interoperability issues, agencies have resorted to a number of methods to relay messages that create time delays, inefficiencies, and risks which can literally determine the difference between life and death. Well-publicized incidents, such as the Rodeo-Chediski fire described in Appendix A, as well as thousands of day-to-day events are hampered by radio interoperability issues that force public safety personnel to employ workarounds in order to perform their required duties. Multi-jurisdictional interoperability is also challenged by budget cycles, radio spectrum, limited planning, incompatible equipment and proprietary protocols. Finally, since the tragic events that occurred on September 11, 2001, the national and state focus on homeland security has further emphasized the critical need for radio voice and data technologies to support public safety "first responders" into the future.

> *"Keeping our people safe must always be our top priority. That's why we're moving Arizona forward by including all of Arizona's first responders in our state's interoperability solution. This is an important tool that we must use not only in our homeland security plans, but each and every day throughout Arizona."*
>
> Janet Napolitano, Governor of Arizona

The Public Safety Communications Commission (PSCC) was formed via Senate Bill 1412 to address interoperability issues in the State of Arizona and begin the process of identifying a strategy, proposed solution, and the funding needed to achieve statewide interoperability. The PSCC defines the overall goal of interoperability as *"seamless interagency and inter-discipline public safety communications without complicated processes or procedures for task force events, mutual aid incidents as well as day-to-day operations irrespective of agencies' technical systems."*

The PSCC recognizes that the lack of sufficient interoperable public safety communications results in prolonged time requirements for first responders to properly communicate and convey critical information about an incident. In total, these primary interoperability deficiencies result in:

- Increased risk of loss of life and property
- Cumbersome coordination and execution
- Inefficient use of resources
- Higher risk to responders
- Inconsistent service across urban and rural areas
- Increased support costs

The PSCC has made significant strides in analyzing options and pushing the agenda to define, fund, and implement a statewide interoperable solution to address interoperability issues. Through the development of the Concept of Operations (ConOps), the PSCC aims to further develop stakeholder understanding of the problem as well as define the objectives and activities required to realize the short- and long-term strategy for establishing radio interoperability in the State of Arizona.

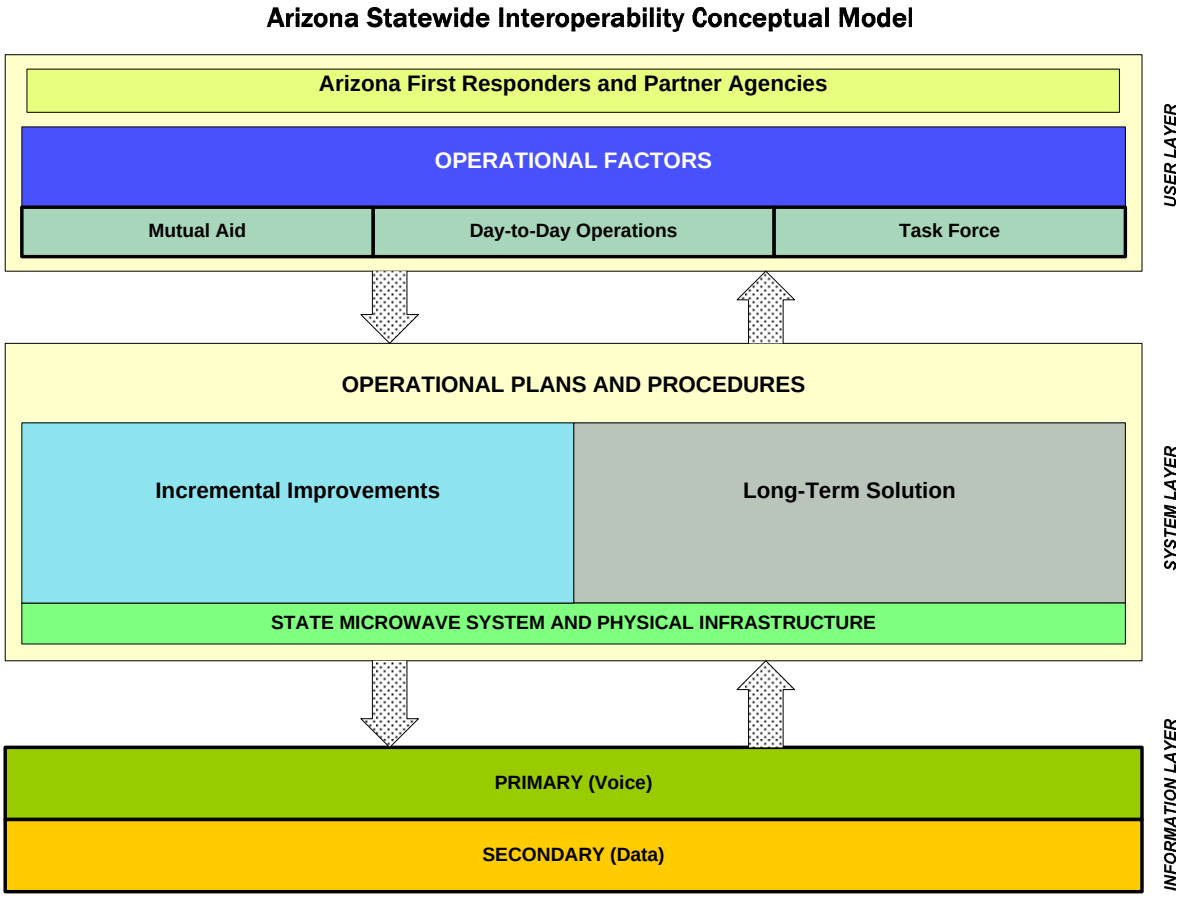
The proposed solution to achieve statewide interoperability focuses on key requirements, the future vision for operations among and within disciplines and jurisdictions, and ownership and governance needs. It includes five primary changes to the current method of operation, in the view of the PSCC Commissioners, which fall into the following five areas:

- Operational procedures and coordination
- Mutual aid operations
- Infrastructure enhancement
- Training
- User-based standards for technology

Based on requirements and changes in the above areas and other supplementary areas, a conceptual model for the future solution was developed. The model is intended to serve as a communications tool for stakeholders to gain buy-in and consensus on the proposed solution and underlying strategy. The model includes technology components at a high-level, but also illustrates key process and operational changes that must also occur in order to achieve interoperability.

The conceptual model is comprised of three interrelated components: the user, system, and information layers. The model illustrates the flow of information from the information layer through the system layer for use by the user layer during the provision of public safety for the citizens of Arizona. Refer to the figure on the following page for an overview of the conceptual model and to the body of the ConOps for additional details on the concepts within.

Figure 1. Conceptual Model for Future Arizona Public Safety Interoperable Solution



To achieve the short- and long-term solution illustrated in the conceptual model above and described in detail in the body of this document, a strategy and corresponding implementation plan were developed by the PSCC.

Strategy and Implementation Plan

The strategy for achieving public safety land mobile radio communications interoperability has both a short- and long-term component. In the short-term, it is imperative the PSCC and its constituents aggressively pursue the defined county-by-county incremental improvements, achieve several quick wins that can be communicated to stakeholders, and expand the influence of the PSCC itself. Addressing operational policies and procedures immediately, for instance, allows for significant progress while more time-consuming efforts, such as securing funding and procurement activities, are executed in parallel. In brief, the short-term strategy for the PSCC to pursue during the next several months to three years is comprised of the following:

1. Publish an initial set of user-based standards and guidelines consistent with the long-term strategy for agencies currently implementing changes
2. Create a scorecard to assess current and ongoing interoperability activities occurring throughout the State and in adjoining states
3. Complete analyses and other data gathering efforts to feed subsequent activities of the

statewide strategy

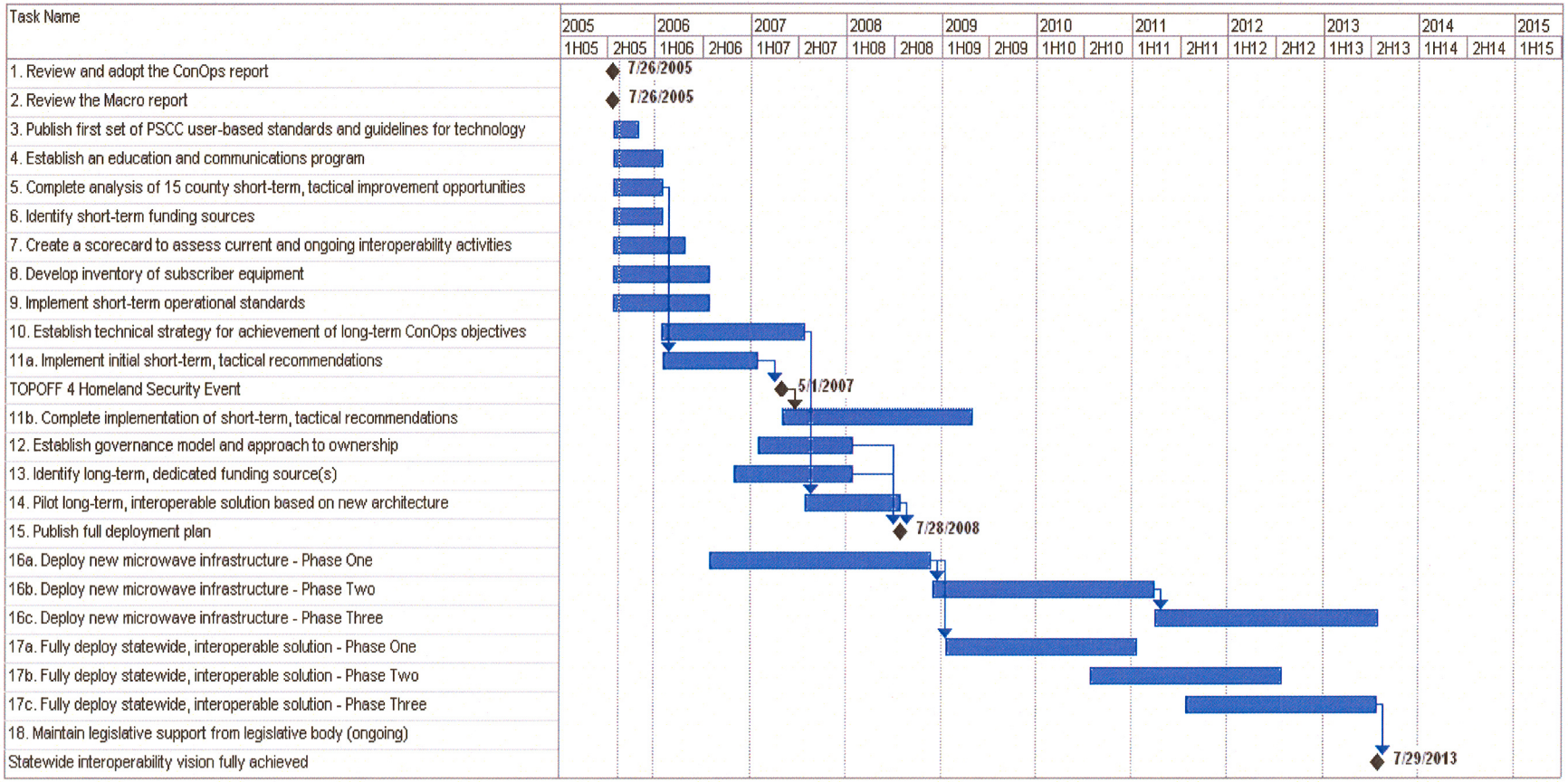
4. Develop and implement a strategy for defining technical alternatives for the statewide solution
5. Establish an education and communications program that defines interoperability, PSCC goals, and the path to the solution
6. Develop an inventory of subscriber equipment to assist with defining the scope and funding requirements for a future solution
7. Develop and implement statewide operational standards
8. Aggressively identify and secure dedicated funding source(s) and secure short- and long-term legislative support by legislative body
9. Assess and implement tactical improvements on a county-by-county basis to achieve quick wins that can be recognized and communicated as progress
10. Establish/leverage working groups and subcommittees to address operational policies and procedures, governance and ownership, and funding strategies
11. Encourage opportunities to share communications facilities and infrastructure among agencies

The long-term strategy, which roughly begins after the TOPOFF 4 Homeland Security event in 2007, should build off of the achievements and momentum of the short-term strategy, and should meet all of the requirements and objectives described in this document and supporting documentation. Long-term agreements to share facilities and infrastructure, increased cooperation and partnership in provision of public safety, and user-based standards and guidelines for technology are a few of the long-term strategies that should be achieved. As such, the long-term strategy, spanning Years 3 through 8, is comprised of the following:

1. Secure long-term funding support
2. Define a long-term governance and ownership model
3. Pilot the interoperable solution based on the new architecture to assess effectiveness and plan for statewide deployment
4. Publish full deployment plan and partially deploy statewide, interoperable solution
5. Deploy new microwave infrastructure
6. Fully deploy statewide, interoperable solution

The following project plan conveys the major components of the short- and long-term strategies for achieving statewide interoperability in the State of Arizona. Through execution of this plan, the State can address the critical communications issues facing public safety and realize the vision for radio interoperability shared by the PSCC and the State of Arizona.

Figure 2. Arizona Statewide Interoperability Project Plan



The PSCC is committed to aggressively pursuing the strategy defined in the ConOps to meet the 18 key milestones required to achieve statewide public safety land mobile radio communications interoperability. To express their continued dedication to this critical effort, the current PSCC Commissioners each signed below to adopt the ConOps as the blueprint for achieving statewide interoperability.

Table 1. PSCC Commissioner Signature Block in Support of the ConOps

Name	Signature
Roger Vanderpool Director, Arizona Department of Public Safety	
Ray W. Allen Assistant Chief, Tucson Fire Department	
Amy Brooks Captain, Apache Junction Fire Department	
Hal Collett Sheriff, La Paz County/Arizona Sheriffs Association	
Gordon Gartner Chief, Payson Police Department	
Jan Hauk President, Arizona Fire District Association/Buckeye Valley Fire District	
Richard Miranda Chief, Tucson Police Department	
Tracy L. Montgomery Commander, Phoenix Police Department	
Kathleen Paleski Commander, Northern Arizona University Police Department	
Daniel Sharp Chief, Oro Valley Police Department	
Lou Trammell Deputy Director, Division of Emergency Management	
Dan Wills Battalion Chief, Sedona Fire District	
Kenneth Witkowski Chief, Gila River Indian Community Police Department	
Dewayne Woodie Fire/EMS Captain, Ganado Fire District	
Michael Worrell Captain, Phoenix Fire Department	

1.0 Introduction

1.1 Purpose of Document

The Concept of Operations (ConOps) document is intended to succinctly describe the current issues and impacts of public safety interoperability issues throughout the State of Arizona in an effort to communicate the need for action to a variety of audiences. The ConOps will greatly aid in the development of stakeholder understanding and consensus as to the vision and scope of the project and should be subsequently used to further gain and maintain support for the project as it proceeds.

There are a number of key stakeholder groups that are targeted audiences for the ConOps document and subsequent efforts generated through the interoperability initiative. The major stakeholder groups comprising the audience for this document are as follows:

- Elected and appointed officials
- State and local public safety entities
- Citizens of Arizona
- Civic leadership forums
- Public safety associations
- Federal agencies
- Tribal Nations
- Professional organizations
- Vendors
- Critical infrastructure companies
- Media

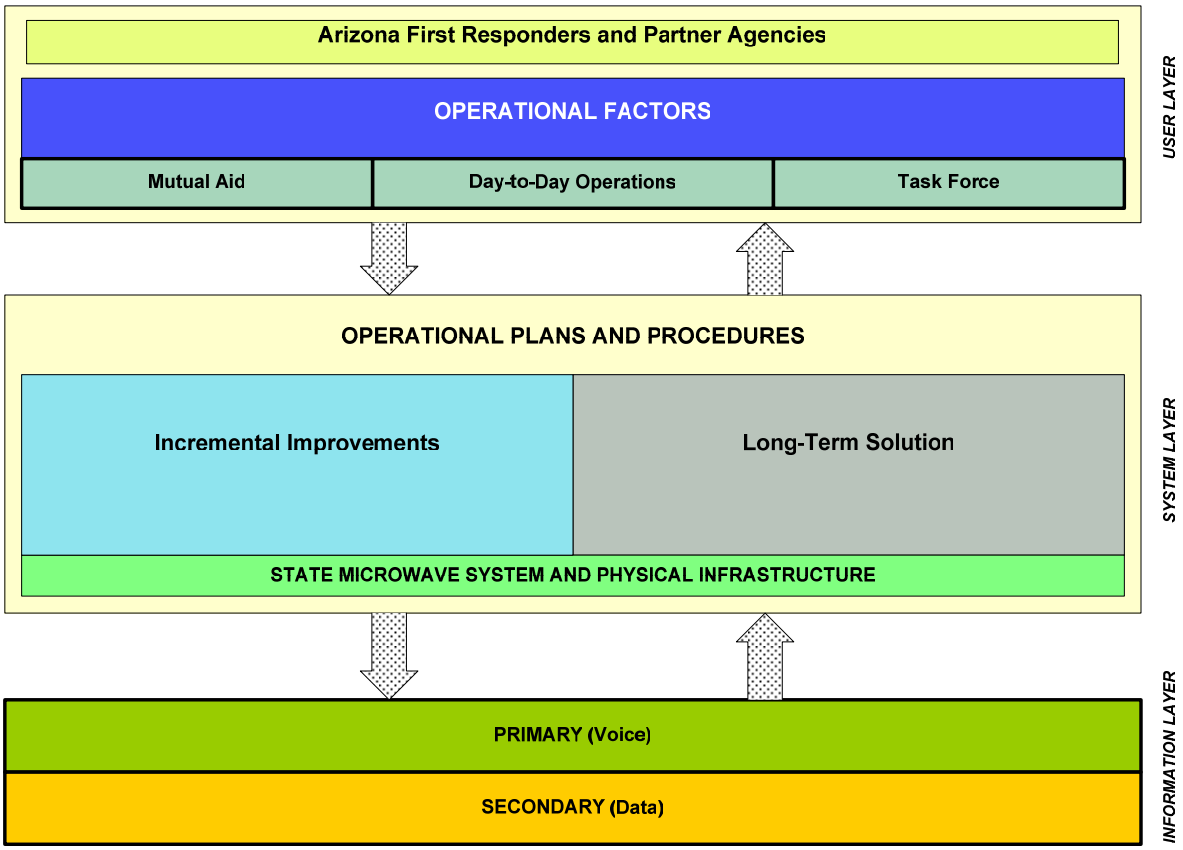
The aim of the ConOps document is to educate stakeholders and the citizens of Arizona on the critical interoperability issues, their historical and potential impacts, as well as the solution and activities that must occur to effectively protect life and property in the State of Arizona. The ConOps conveys key information to key stakeholder groups by describing users' operational needs without becoming "bogged down" in detailed technical issues that will be addressed during future systems analysis activities. It is intended to be a mechanism for documenting the issues, requirements, and plan for action in a manner that can be verified by the users without requiring any technical knowledge beyond that required to perform normal job functions.

The remainder of the document describes radio interoperability issues and key requirements for the proposed solution for the State of Arizona and additional supporting information to lay the foundation for the conceptual model of the future statewide interoperable solution for the State of Arizona. The conceptual diagram on the following page is introduced to establish a baseline understanding of the future concept for interoperability prior to describing the background and issues creating the glaring need for the new operational model.

The conceptual model is comprised of three interrelated components: the user layer, the system layer, and the information layer. The model illustrates the flow of information from the information layer through the system layer for use by the user layer during the provision of public safety for the citizens of Arizona. For a more detailed description of the conceptual

model, please refer to Section 5.3.

Figure 3. Overview of Conceptual Model of Future Arizona Public Safety Interoperable Solution



The concepts and relationships depicted in the conceptual model are subsequently described in the remainder of the document. It begins with a statement of the problem that should be aggressively addressed by the State of Arizona and an overview of the Commission constructed to define and implement a solution.

Through the ConOps, the Public Safety Communications Commission (PSCC) strives to provide a clear picture of the magnitude and gravity of current radio interoperability communications problems experienced by public safety agencies in the State of Arizona. Moreover, the PSCC aims to provide a clear concept for the proposed solution to remedy these critical problems in addition to the activities and tasks that must be executed to achieve statewide interoperability.

2.0 Background and Statement of the Problem

2.1 Statement of the Problem

Although citizens depend on and value the critical assistance provided by public safety agencies, many are not aware of the extreme efforts that public safety providers are forced to employ to simply communicate with each other to protect lives and property. All aspects of public safety operations — from the day-to-day incidents to disasters that require numerous agencies — suffer from radio communications issues, which hamper the ability to effectively respond to issues and create delays and risks that can carry grave consequences.

When multiple agencies from different or multiple jurisdictions currently respond to incidents, they often have incompatible radio equipment and use different frequency bands for radio communications, rendering communications difficult, if not impossible. As a result, agencies have resorted to a number of methods to relay messages that create time delays, inefficiencies, and risks which can literally determine the difference between life and death.

The State of Arizona is at a crossroads in its provisioning of public safety land mobile radio communications services. Multi-jurisdictional interoperability is challenged by budget cycles, radio spectrum, limited planning, incompatible equipment and proprietary protocols. Furthermore, since the tragic events that occurred on September 11, 2001, the national and state focus on homeland security has further emphasized the critical need for radio voice and data technologies to support public safety “first responders” into the foreseeable future.

While all public safety agencies have a need to upgrade communication capabilities to serve their specific communities, it became clear that a greater statewide effort was necessary to address multiple-agency/cross-jurisdictional communications needed during large-scale events and natural disasters affecting the state. Moreover, many citizens are not privy to the cumbersome technical and operational workarounds employed by public safety providers to provide services and conduct day-to-day operations.

To address these issues, a vision for a modern statewide voice and mobile-data network which will support local public safety operations as well as providing a robust statewide infrastructure to support wide-area coverage for all agencies has been developed over the past few years. It is widely understood that this initiative is a long-term, complex and expensive undertaking that requires a high level of accountability, management and operational control to be successful. Therefore, it is critical that the issues are clearly defined, a plan of action is created with key milestones and resource requirements, and appropriate political backing and funding are secured to achieve the vision.

Currently, the statewide microwave network and associated state agency radio systems are managed by engineers and technicians employed by the Arizona Department of Public Safety (DPS). The state-owned microwave network, which could serve as the statewide infrastructure, is badly in need of modernization, including a need to transition from analog to digital technology. The four- to five-decade-old technologies and infrastructures of concrete and steel in Arizona have survived well beyond their anticipated life cycles and are in desperate need of replacement and modernization. DPS staffing levels and current funding are inadequate for the proper planning, development, deployment and operational management of any future network that becomes a part of the State's public safety infrastructure. Further, this issue transcends the needs and sole use of state agencies since it affects all public safety entities working within the state.

Several critical problems are borne as a result of the aforementioned radio interoperability and infrastructure issues:

- Increased risk of loss of life and property
- Delays in providing timely public safety
- Resource and process inefficiencies
- High support costs for aging, disparate radio systems

While many of these issues may not be visible to the average Arizona citizen, the dedicated public safety agencies within the State live with these issues and are consistently hampered by radio interoperability problems despite impressive efforts to overcome them. Unfortunately, unless interoperability is efficiently and effectively addressed now, it may take a disaster or other critical event to expose and address these critical issues facing the State of Arizona.

2.1.1 Overview of Interoperability

The concept of interoperability takes on a number of meanings but in the realm of public safety it generally refers to the ability of emergency responders to operate in a seamless fashion with other systems. In fact, SAFECOM, a federal program that provides guidance and support for initiatives and projects pertaining to public safety communications and interoperability, defines interoperability as *"the ability of public safety officials to share information via voice and data signals on demand, in real time, when needed, and as authorized."*[1] The National Institute of Justice defines interoperability as *"the ability to talk and/or share data in real time between field units and/or agencies" and states the primary objective of interoperability as the "ability for persons who need to exchange information to be able to do so, even when they are using incompatible radios, without the need for custom equipment."*[2]

In an effort to gain consensus and define a common vision for interoperability in the State of Arizona, the PSCC Commissioners developed their own modified definition for interoperability, illustrated below:

> *"Seamless interagency and inter-discipline public safety communications without complicated processes or procedures for task force events, mutual aid incidents as well as day to day operations irrespective of agencies' technical systems."*
>
> PSCC Commissioners

Furthermore, statewide interoperability should include non-traditional public safety agencies, recognize the complexity of communications to address disciplines, jurisdiction, inter-agency frequencies, etc., and should be supported by an effective incident command structure and operational procedures. The importance of the operational procedures to support interoperability is essential as many of the problems experienced today are not technology-related and pertain to the interrelated actions of numerous public safety agencies and their partners.

Examples of these operational issues are prevalent throughout Arizona and the United States at large. In fact, despite the success achieved in the Pinal County Weapons of Mass Destruction/Chemical Terrorism Exercise, which is described in detail in Appendix A, the primary weaknesses of the operation included weak standard operating procedures and guides

[1] Source: SAFECOM: http://www.safecomprogram.gov/SAFECOM/interoperability/default.htm

[2] Source: National Institute of Justice: http://www.agileprogram.org/documents/comm.pdf

for a multi-agency response, as well as training gaps. Irrespective of any incremental and major technology improvements are the operational issues that impact the success of day-to-day public safety service.

2.1.2 Impact on Provision of Public Safety in the State of Arizona

Public safety is directly impacted by the lack of interoperability on a day-to-day basis. In addition to the impacts described in Section 4, Justification for and Nature of Changes, the most critical and salient impact of poor interoperability is increased risk of lost lives and destruction of property. The magnitude and importance of these negative impacts are understood by all levels of government in Arizona, as exemplified by a recent quote from Governor Janet Napolitano.

> *"Keeping our people safe must always be our top priority. That's why we're moving Arizona forward by including all of Arizona's first responders in our state's interoperability solution. This is an important tool that we must use not only in our homeland security plans, but each and every day throughout Arizona."*
>
> Janet Napolitano, Governor of Arizona

The cumbersome coordination and execution employed to provide basic public safety support in the State of Arizona breeds additional issues. For instance, the inefficient use of resources to communicate and the high support costs of numerous, disparate systems are felt by all public safety agencies. In addition, the increased risk to public safety personnel is another major concern as personnel are often unaware of dangerous circumstances, such as armed suspects, due to communications problems between agencies and disciplines.

Beyond potential risks created by the lack of interoperability in the State of Arizona, there are recorded, historical events, many of which are commonly known by Arizona citizens, which were caused or worsened by a lack of efficient communication. To assist in conveying the real impacts of interoperability, examples of historical events exhibiting poor interoperability are presented in Appendix A.

The impacts of a lack of interoperability are critical and are even magnified by the threat to homeland security since the events of September 11, 2001. Arizona public safety officials have lived with this major issue for far too long and require support from legislators and other key stakeholders to clearly define and fund a solution. The criticality and desire for immediate action can be best conveyed through a recent quote from the Department of Public Safety (DPS) Director Roger Vanderpool. The formal establishment of the PSCC through the passing of Senate Bill 1412 was a watershed event in addressing statewide interoperability issues and providing the money and resources required to develop and implement a solution. The PSCC background and key objectives are described in the next section.

> *"A top priority is interoperability (for) the first responders of Arizona; enabling them to talk to each other. When you have an emergency, when you have a disaster, if you can't communicate, you've got chaos. We've talked about this and talked about this and talked about this for years. We've got to do something."*
>
> Roger Vanderpool, Director of DPS

2.1.3 Public Safety Communications Commission Background

The PSCC was created by concerned public safety officials to address interoperability and develop a short- and long-term solution for the issues described above and further illustrated throughout this document. The PSCC originated as an ad hoc committee comprised of

dedicated public safety officials who volunteered their time and energy to addressing the short- and long-term interoperable communications needs for all public safety entities in the state of Arizona. The committee was formed in April of 2000 to educate its members and community stakeholders on the critical need for interoperability and to begin the process of identifying funding for this long-term enterprise. The PSCC membership has shared one central focus: *to develop a standards-based, shared voice and data radio system that efficiently and effectively addresses the front-line needs of its users to protect life and property.*

The PSCC began meeting on a quarterly basis and established subcommittees to educate stakeholders on interoperability issues and assist in identifying funding sources. With the assistance of the Arizona Criminal Justice Commission (ACJC), a federal appropriation earmark was secured to fund a study of public safety communications systems in use throughout Arizona. This study was the critical first step required to begin the development of a conceptual model and detailed technical design that would set the course for future public safety communication systems in Arizona.

Now officially organized as the Arizona Public Safety Communications Advisory Commission (continuing to be known as PSCC), the commission is building on the work already begun. The current list of PSCC Commissioners and their respective terms are listed in Appendix B. Although the group of Commissioners comprising the PSCC will undoubtedly change during the course of the interoperability initiative, the initial group of Commissioners should be commended for their dedication and persistence in championing the interoperability cause and making significant progress.

In support of the Commission, the PSCC support staff fosters, recommends and develops technical standards; oversees conceptual and detailed design efforts; and pursues funding to build out and maintain a statewide system for use by all local, state, sovereign tribal nations, and federal public safety entities in Arizona. The PSCC will continue to work closely with local, county, state, tribal nation and federal partners to achieve communications interoperability and improve the effectiveness of public safety in the State of Arizona.

3.0 Current System

Understanding the state of the current radio systems within the State of Arizona is required to comprehend the necessary changes required to achieve statewide radio interoperability. While the description largely avoids detailed technical information, some technical specifics are provided to educate the reader on the current technologies and other issues facing public safety agencies in the State of Arizona. Given the fact that the supplementary technical information is at the same time vital to determining the solution, but excessively granular for the body of this document, the additional information is presented in Appendix C. Information is provided for the major jurisdictions within the State, namely: state, county, city/town, fire district, tribal nation, and federal. The current system information provided for each of these jurisdictions in Appendix C is further grouped into the following areas:

- Mobile radio systems
- Subscribers
- Coverage
- Frequency
- Traffic capacity
- Interference
- Dispatch centers
- Microwave linking
- Security
- Reliability
- Maintenance

Where appropriate, generalities or common traits are highlighted in the section below to provide a complete picture of the current state of radio communications in the State of Arizona. The summarized material in this section was predominately aggregated from previous comprehensive reports created by RCC Consultants, Inc. and Macro Corporation.

3.1 Description of the Current Environment

In all, there are relatively few significant differences between state, county, city, town, fire district or tribal nation systems in the State of Arizona with regard to coverage, reliability, interoperability, or age. The majority of public safety systems in Arizona are operating on an old and often unreliable infrastructure, and do not have the interoperability deemed necessary for today's environment. Three significant exceptions, 1) the new Phoenix/Mesa 800 MHz Project 25 digital trunking system still under implementation, 2) the new VHF narrowband system ordered by Cochise County, and 3) the Pima County system that has recently been funded, provide more modern infrastructures that may be leveraged as part of the statewide solution.

3.1.1 Current Systems

The State of Arizona currently has three primary voice radio systems capable of enabling inter- or intra-disciplined communications, which are as follows:

- The Interagency Radio System (IARS)
- Fire Mutual Aid Channel
- Emergency Medical Services Communications System (EMSCOM)

Not all agencies have or are utilizing these systems and these systems are not adequately deployed, thus inhibiting seamless statewide communications.

Mobile radio systems within the State of Arizona vary from single-channel, single-site low band VHF to 800 MHz wide-area simulcast Project 25 compliant-trunking systems. Technologies including analog, digital, trunking, and simulcast are all in use by some agencies in Arizona. Systems capacities vary from single channel with five users to modern trunking systems designed to accommodate 15,000 users.

In respect to frequency usage for the provision of public safety, systems are installed in each of the frequency bands listed below:

- VHF Low Band
- VHF High Band (Wideband)
- VHF High Band (Narrowband)
- UHF (Wideband)
- UHF (Narrowband)
- UHF (Federal Government Band)
- 800 MHz (NPSPAC)
- 800 MHz (General Category)

A common trait among most of the systems is that the designs and associated infrastructures are very old. A lot of systems have had the subscriber equipment replaced at least once; however, most of the base stations, towers, remote site buildings, standby AC generators, battery plants, transmission lines and antennas are more than 20 years old, with the exception of a few very new systems just under implementation.

3.1.2 Users

The largest user of private mobile radio technology in Arizona is public safety, which is the responsibility of numerous agencies at all levels of government. In addition to public safety, other users include the Arizona Department of Transportation (ADOT), state and federal agencies, public works departments, power and gas utilities, cable TV suppliers and telephone companies. Arizona is similar to many other states in that mobile radio systems evolved over time and, as a result, each agency owns and operates a private mobile radio system designed specifically to meet its own specific needs.

3.1.3 Current State of Interoperability

In light of the fact that interoperability is the desired goal of the PSCC and public safety agencies throughout the State of Arizona, the current state of interoperability as it relates to

each jurisdiction is provided in more detail. Use of frequency exchange with peer agencies is a common method to enable interoperable communications today. Another common occurrence is the use of two radios, typically both VHF and UHF, in public safety vehicles to mitigate risks of communication issues due to disparate systems or band usage. IARS employs cross-banding to enhance interoperability, but performance can be poor and some counties lack coverage. Finally, cell phones are becoming the de facto standard for interoperability between state and local law enforcement. Refer to the table below for an overview of the current state of interoperability by jurisdiction.

Table 2. Current Interoperability by Jurisdiction

Jurisdiction	Description of Current State
State	■ Frequency band differences between DPS and most County Sheriff's Offices and local Police Departments create issues ■ Interoperability in the Phoenix area is either limited or non-existent ■ Majority of interoperability attained with DPS Highway Patrol is through expensive installation of UHF and VHF mobiles in DPS vehicles ■ Interoperability also achieved through each agencies respective Dispatch Center ■ State operates a VHF and UHF system which is cross-banded to enhance interoperability (IARS); does not always work well and does not have coverage in some counties. ■ Department of Transportation and Game and Fish operate on VHF wideband, Game and Fish has an MOU with other county and local agencies for frequency exchange to permit a degree of interoperability ■ Trunking is challenging in that although some state agencies have compatible equipment, they cannot access local systems due to lack of IDs to log on
County	■ Most counties and the local police and fire departments within the county are on the same frequency band ■ Interoperability is achieved today by frequency exchange when the band is common ■ Agencies that do not share a common band have little to no interoperability except by manual means via their respective dispatchers ■ Some counties have the IARS channels terminated on the sheriff's office consoles providing access to this system and the ability to patch ■ Some counties have the national mutual-aid channels including I-Call and I-Tac when they operate in the 800 MHz band ■ County sheriff's offices in Mexican border counties have a need to interoperate with the federal agencies active in the area
City/Town	■ Generally achieve interoperability by frequency exchange with their peer agencies ■ Agencies that do not share a common band with their peers have little to no interoperability, except by manual means through their respective dispatch centers ■ Some cities have cross-band radios in their dispatch centers such that they can communicate with adjacent agencies in another frequency band ■ Some cities have mutual aid and/or the IARS channels terminated on their consoles to provide patching to their own channels

Jurisdiction	Description of Current State
Fire District	■ Radio communications and cooperation problems often occur when several agencies respond to a common incident or emergency ■ Due to frequency band differences, most fire districts cannot communicate with DPS
Tribal Nation	■ Most interoperability accomplished by frequency exchange with peer agencies ■ Some tribal nations do not recognize any formal MOU for frequency exchange, and sometimes it is a one-way exchange ■ Tribal nation police vehicles often have two mobile radios installed; in other cases, tribal nation dispatch connects systems together at the audio level or have both VHF and UHF control stations
Federal	■ Most interoperability achieved through frequency exchange with local law enforcement agencies ■ Agencies have access to a police radio group that can purchase radios, of any configuration, in any frequency band, on short notice, for a particular operation ■ DEA vehicles also equipped with dual band VHF/UHF radios ■ Trunking is challenging in that although some federal agencies have compatible equipment, they cannot access local systems due to lack of IDs to log on

As can be seen in the table above, some of the problems experienced, as well as some of the solutions implemented, in response to interoperability issues are common across jurisdictions. Moreover, some of the same interoperability issues also impact private partners, such as ground and air ambulance companies and tow truck companies. However, the differences in needs and current interoperability status will require a robust solution that can not only define statewide user-based standards for technology, but also allow flexibility to meet the specific needs of each jurisdiction, area, and discipline.

3.2 Operational Policies and Constraints

Operational policies to support the new model will be paramount as public safety agencies struggle with these issues on a day-to-day basis. In fact, as described in Section 4.2.1, operational procedures and coordination are viewed as the most critical components required for the future statewide system in the view of the PSCC Commissioners. Some progress has been made on a regional basis to address the operational issues but they are still prevalent and significant. For example, determination of which agencies should use which radio channels may not appear to be a pressing issue, but in practice it impacts Arizona public safety agencies on a daily basis.

The key operational issues the PSCC and stakeholders should strive to effectively address are:

- **Incident Command Structure —** Critical to the success of public safety emergencies is the determination of which parties are responsible for deploying resources to the right places at the right time. The incident command structure governs these dynamics and must be revisited given the breadth and depth of changes desired by the State.
- **Channel Usage —** Any constraints related to channel usage should be explored to understand if there are improvements that can be made in terms of radio channel usage

in support of the provision of public safety. Deciding on the optimal use of channels for a given incident, jurisdiction, discipline, etc., requires a thorough analysis of opportunities and limitations.

- **Memoranda of Understanding —** Underpinning all operations and decisions related to collaboration and partnerships will be memoranda of understanding clearly dictating the bounds and scope of the relationships. As is true with any negotiation effort, this can be a painstaking effort and should be diligently pursued.
- **Training and Practice —** Testing the procedures and incident command structure, in addition to any technological changes, will need to be effectively addressed. Exercises similar to those described in Appendix A should be consistently employed.
- **Policies and Procedures —** Given the breadth of resources involved in any given incident, clear policies and procedures should be developed and promulgated. The PSCC will be challenged in some instances to garner full support of policy and procedure changes and should plan accordingly.
- **Partnerships —** Operational collaboration and the sharing of infrastructure, facilities and resources will be critical to changing the status quo. Partnerships may also include private-sector organizations in addition to traditional public safety agencies.

3.3 Modes of Operation for the Current System

Although modes of operation are unique based on the operational factors and specifics of the incident or event, there are three modes of operation that are consistent across jurisdictions and disciplines. These three modes are:

1. Day-to-day operations
2. Task force operations
3. Mutual aid operations

3.3.1 Day-to-Day Operations

Day-to-day operations are the most frequent and encompass a range of incidents and correlated responses by public safety agencies. The distinguishing factor, in comparison to planned events, is the absence of pre-planning and lead time prior to an incident. The unpredictable nature, frequency, and timing of day-to-day incidents render planning impossible. As a result, interoperability problems and impacts are often exacerbated. For example, pursuit of a suspect will often require cross-jurisdictional support. Although the pursuing officers should expect seamless communication with dispatch and partner public safety agencies, disparate systems, spectrum, and subscriber equipment often create communication issues that negatively impact public safety. For example, interoperability issues in northwest Arizona related to pursuits often result in Kingman police and DPS officers reverting to hand signals between each other to communicate. Additional information on this cross-jurisdictional pursuit example can be found in Appendix A.

3.3.2 Task Force Operations

Task force events, such as sporting events and visits by politicians or dignitaries, are characterized by a defined date, time and duration that are known prior to the need for communication among and between agencies, disciplines, and other involved parties. The lead time for planned events allows agencies to coordinate communication and establish one-time

interoperable solutions for the task at hand. While the coordination efforts are often laborious to execute and are still rife with problems, the preparation time often mitigates major risks and inefficiencies that can occur during the course of the event.

3.3.3 Mutual Aid Operations

A final mode of operation that is worthy of note is mutual aid operations, such as fires, floods, and other disasters that involve a number of agencies over a period of weeks or months. In these situations, a unique communication system is established at the site of the incident to not only ensure communication between agencies, but also to facilitate implementation of the incident command structure, critical in events of magnitude. While this mode of operation occurs less frequently than the previous modes described, the magnitude and critical nature of these types of events heightens the need for a new model for radio interoperability.

3.4 User Classes and other Involved Personnel

3.4.1 Profiles of User Classes

The primary user classes that require seamless interoperable radio communications can be delineated in a number of ways. However, considering the statewide focus of the PSCC and the interoperability initiative, user classes were primarily divided by jurisdiction with some discipline considerations included to complete the balance of the user base. The seven primary user classes are:

1. State agencies
2. County agencies
3. City/Town agencies
4. Fire District agencies
5. EMS providers
6. Tribal Nation agencies
7. Federal agencies

These user classes represent the major groups of public safety agencies and other partners that typically respond to incidents in the State of Arizona. The interaction between user classes depends on the location and circumstances of the incident, but any interoperability solution should ensure seamless radio communications between and within these user classes.

3.4.2 Interactions Among and Between Disciplines

Beyond the primary user classes stated above, there are multi-agency and inter- and intra-discipline communication needs that should be addressed by the statewide solution. As evidenced by the after-action reports and the operational scenarios in Appendix A, many incidents require communication among and between law enforcement, fire, EMS, and other disciplines. Incidents that occur on a county border, for instance, require, at a minimum, communication between multiple law enforcement agencies. Large-scale incidents, such as the mutual aid operations, require significant communication between as many as a dozen agencies for long periods of time. Therefore, it is vital that these interactions are factored into the long-term solution and that the solution has the flexibility to provide seamless communications for day-to-day, task force, and mutual aid incidents involving multiple Arizona agencies.

3.4.3 Other Involved Personnel

In addition to the traditional public safety agencies that are first responders, such as law enforcement, fire, EMS, and the other agencies collectively described in Section 3.4.1, there are other agencies and organizations that contribute to the provision of public safety that need to be included in the interoperability solution. Ancillary support agencies include critical infrastructure providers (water, power, and telephone), transportation, traffic control, land management, health services, vehicle support and recovery, media, Red Cross and others. Further, private ambulance companies and other private entities are often included in the provision of public safety in the State of Arizona.

4.0 Justification for and Nature of Changes

This section illustrates the interoperability problems of the current system and supporting operations and the impacts of these problems to the State of Arizona. Subsequent to the definition of the key problems is a description of the primary changes supported by the PSCC and the benefits the State will reap from this approach.

4.1 Justification of Changes

Gaining support for the statewide radio communications interoperability initiative in the State of Arizona requires a clear picture of the key problems public safety agencies are facing as well as the improvements and benefits that can be achieved by changing technology and process to alleviate these problems. Through the illustration of the key problems and the improvements that will remedy the problems, the PSCC can effectively communicate the clear need for immediate action and justify its call to action.

4.1.1 Deficiencies and Limitations of Current System

The most salient issue that can directly result from lack of interoperability is the loss of life and property. The extra time required to communicate through agencies' respective dispatch centers simply to convey critical information about an incident to another public safety resource can mean the difference between life and death. Even in situations where the circumstances around an incident are not as severe as a life or death situation, the wasted time required to establish basic communication is misapplication of public safety resources. The primary deficiencies of the current system can be grouped into six areas, which are described below:

- **Increased risk of loss of life and property —** The most critical and important deficiency of the current system is the increased potential for loss of life and property. As exemplified by the Rodeo-Chediski fire and a number of similar incidents, public safety agencies are often unable to communicate on-site, creating a dangerous situation for resources that do not have a full picture of the situation. Delays in communications impact the ability of responders to efficiently respond, thereby increasing the risk of death or injury for Arizona citizens in the midst of a dangerous situation.
- **Cumbersome coordination and execution —** Operational procedures and incident command structure vary across the State and can create challenging communication issues at the site of an incident. Compounding the problem are disparate systems and technologies that create cumbersome solutions for agencies, often resorting to dedicating a resource to physically stand next to partner agency representatives to ensure coordination and execution are successful.
- **Inefficient use of resources —** A direct result of interoperability issues is the need for additional resources at incident sites as well as support from dispatch centers to compensate for communications deficiencies. Redundant resources deployed to compensate for poor communication among agencies could be redirected to other locations or activities. In addition, the time required to effectively address an incident is lengthened due to interoperability issues, thereby wasting resource time.
- **Higher risk to first responders —** First responders without complete information about an incident put themselves and citizens at a higher risk of injury or death. Officers often do not know the suspect's description, whether the suspect is armed, or the mode of transportation used by the suspect, and cannot ask partner agencies at the scene

because radio communications will not support it. Hence, the risk of loss of property and the lives of Arizona citizens and public safety officers are higher under the current operational model.

- **Inconsistent service across urban and rural areas —** Due in part to the interoperability issues described in this document, the ability to provide public safety services to the citizenry in rural areas is not on par with the services available to the citizenry in urban areas. In some cases, the basic tools for communications and interoperable communications are not available. System coverage is a limiting factor that impacts the provision of public safety.
- **Increased support costs —** Supporting the disparate systems throughout the state requires a broad range of technical knowledge and skills that create higher collective support costs for the public safety agencies in the State of Arizona. Common technologies and subscriber equipment can aid in streamlining support and obtaining volume discounts that can lower the total cost of ownership of the system.

4.1.2 Benefits Achieved Through Change

By implementing the concepts and requirements for the future system defined in Section 5 and executing the tasks and activities outlined in Section 6, the State has the opportunity to achieve a number of significant benefits that justify the cause for action. This section describes the key benefits that can be realized by pursuing the model and activities prescribed by the ConOps document in support of achieving statewide interoperability.

4.1.3 Description of Benefits

Ultimately, the primary justification for change is the lower risk of loss of life and property and the increased ability for public safety agencies to respond to day-to-day, task force, and mutual aid incidents. Without these improvements, the State is in a vulnerable position that is simply unacceptable given the threats to homeland security and the day-to-day dangers for citizens and first responders of Arizona. In addition to this primary benefit, value can also be realized through improved responsiveness to citizens and other qualitative benefits that can be achieved by implementing the proposed solution. Other benefits include:

- Lower risk of loss of life and property
- Improved operational procedures and execution
- Increased inter-agency partnerships and collaboration
- Faster response
- Enhanced first responder safety
- Improved consistency of operations

A major additional benefit that can be realized through successful implementation of a statewide interoperable solution is the ability to improve the efficiency of first responder resources. By reducing the amount of wasted time establishing and maintaining communications workarounds, first responder efforts can be redirected to other higher priorities or moved to other incidents as appropriate. The resource time saved through well-established interoperability and supporting policies and procedures would be significant for all disciplines and jurisdictions, and this force multiplier would be a major benefit of the statewide solution.

4.2 Description and Prioritization of Desired Changes

Changes to the current systems and methods of operations transcend technology decisions and include policies, processes, human resources, and a number of other factors. The key changes that should occur to achieve success were discussed with the PSCC Commissioners in an effort to understand the required modifications and how to prioritize them. Prioritization of requirements and key changes ultimately defines the solution, as well as the cost, support model, governance and operational procedures to support the solution.

4.2.1 Critical Changes

Using a prioritization exercise at a scheduled Commission meeting, the five most critical changes to the current system were decided on by the Commissioners. Each change is listed below along with a brief explanation of what the change means to the State of Arizona.

- **Operational procedures and coordination —** Irrespective of technologies, subscriber equipment, and infrastructure, the top priority for achieving interoperability is clear definition of operational procedures and coordination among agencies. Collaborative development of improved operational procedures will reap significant benefits and will be the cornerstone of success. Activities in this area can begin immediately.
- **Mutual aid operations —** Major disasters and other incidents requiring multiple public safety agencies for days or weeks at a time should be addressed and improved to enhance public safety. Despite the impressive efforts of public safety agencies, interoperability has hampered the effectiveness of mutual aid operations in the past and should be improved.
- **Infrastructure enhancement —** The aging infrastructure described in Section 3.1 hampers the ability to effectively communicate between agencies. Current plans to upgrade the microwave network should be aggressively pursued to support the interoperability initiative.
- **Training —** To consistently and effectively employ the operational procedures and use of equipment in response to an incident, public safety resources should be thoroughly trained to be prepared for any type of incident. Commissioners agreed that current training efforts are inadequate and should be bolstered, especially in light of the new operational model and technologies that comprise the conceptual solution.
- **Arizona user-based standards for technology -** The definition and promotion of standards for all jurisdictions are critical steps in gaining statewide interoperability. Current and future plans for technology improvements should be guided by technology standards to ensure compatibility and improve technology support.

4.2.2 Other Important Changes

In addition to the critical changes previously described, there are several other important changes that should also be key focuses when developing and implementing the long-term solution for the State. Other important changes include:

- **Local coverage —** Ensuring that local agencies have radio coverage for their respective jurisdictions is a key change. Some agencies simply do not have sufficient communications within the agency, much less with other partner agencies.
- **Day-to-day operations —** The unpredictability of day-to-day operations in terms of the incident circumstances, personnel involved, etc., creates a need for flexibility that is

currently not met. For instance, cross-jurisdictional pursuits carry public safety personnel out of their jurisdictions and require dynamic communications with public safety partners on an as-needed basis. The long-term solution should address this need, which will be a significant change from the current model.

- **Inter-discipline operations —** As noted earlier, any given incident may require law enforcement, fire, and other disciplines to provide the required services to meet the need. Therefore, the inter-discipline operational and technical changes that should be employed to ensure seamless interaction will be a significant change in the new model.
- **Additional spectrum/channels —** Exploration of additional spectrum and channel use will be a major focus for the PSCC as a statewide solution is developed. It is likely the new model will entail some change — still undetermined at this point in time — in the usage of spectrum and channels for communication.

In addition to these highlighted components of the future system, other requirements, such as improved task force operations, enhanced in-building coverage, statewide roaming coverage, subscriber equipment replacement, intra-discipline operations, security, and standard maintenance are also required components of the new system. These requirements are described further in Section 5, Concepts for and Analysis of the Proposed Solution.

5.0 Concepts for and Analysis of the Proposed Solution

The proposed solution focuses on key requirements, the future vision for operations among and within disciplines and jurisdictions, and ownership and governance needs. It is not intended to convey technical schematics or a detailed design for the future statewide solution. Rather, it communicates the key elements of the proposed solution as defined by the PSCC Commissioners and their constituents. A conceptual model is subsequently presented to provide a visual representation of all of the concepts and requirements detailed in the document. This conceptual model serves as a communication tool to stakeholders, as well as vendors, who will ultimately design and propose a specific solution for the State that is based on the critical requirements detailed in the ConOps.

5.1 Description of the Proposed Solution

The proposed solution for achieving statewide radio interoperability among public safety agencies within the State of Arizona is comprised of many facets. To ascertain the most critical elements and priorities for the PSCC and its constituents, the PSCC Commissioners expressed key requirements via a set of group interviews. The solution has been broken down into the following key groups of concepts:

1. System Solution
2. Coverage
3. Interoperability
4. Governance and Ownership

A description of each aspect of the proposed solution and the supporting requirements are described individually below.

5.1.1 System Solution

Irrespective of the technical solution that will ultimately be procured and implemented to solve the major interoperability issues, there are requirements that must be met to address all the issues introduced in Section 4, Justification for and Nature of Changes. While it is imperative that the future system address the broad, varying needs of public safety entities, it should also encompass tactical applications such as in-building communication. Requirements were developed using direct input from Commissioners and material from the referenced documents in Appendix D. The system solution must meet the following key requirements:

- Universal protocols for technology and vernacular/communications
- An integrated solution/system
- Compatibility with current systems
- Clearly defined plan for migration to the new solution
- Ability to support multiple spectrum bands

5.1.2 Coverage

While the vision of complete wireless radio coverage across the entire State that is similar to 9-1-1 coverage — including all terrains, remote locations, and in-building needs — is a utopian vision for interoperability within Arizona, the reality is that there are tradeoffs and prioritization

decisions that must be agreed on. As such, from a coverage perspective, the following requirements must be met:

- The coverage concept may be regional and does not need to be a single approach on a statewide basis
- No solution will likely provide coverage everywhere
- Coverage should focus on where the work is being done by first responders
- Geographical, terrain and site limitation issues impact coverage decisions
- Coverage needs depend on the agencies involved

5.1.3 Interoperability

The key issue discussed in this document, interoperability, has specific meanings that relate to the State of Arizona in addition to the industry-wide and public safety connotations, which are described in Section 2. Based on input from the Commissioners themselves, there are several other key interoperability requirements that must be addressed by the future solution:

- Interoperability must be inclusive of non-traditional public safety agencies
- Incident command structure significantly drives operations and should be tied to any interoperable solution
- Interoperability involves both technical and operational components, and should be seamless and uncomplicated for public safety and related users
- Solution must address the complexity of communications to cover disciplines, jurisdiction, inter-agency frequencies, etc.

5.1.4 Governance and Ownership

Accompanying the selection of the short- and long-term solution for addressing the interoperability problem are key requirements for ownership and governance. The PSCC Commissioners commonly believe that ownership should be shared across stakeholders, but that ultimate responsibility will still need to reside with one body, perhaps the PSCC itself. Other key requirements for governance and ownership in the view of the Commissioners:

- Governance and ownership should leverage knowledge from previous state and local initiatives
- Governance and ownership will comprise two stages for the solution: 1) building the infrastructure funded and governed by the state, and 2) ongoing operations funded and governed by participating agencies
- Governance will change over time, and events (e.g., 9-11) can impact the model
- Type of solution will dictate management and operation of the solution
- Larger entities may have a bigger say in the overall plan and governance
- Explore existing models for ownership and governance to ascertain applicability:
  - e.g., ACJIS, Michigan, Criminal Justice Commission, Las Vegas, Phoenix

5.2 Short- and Long-Term Components of the Solution

Due to the fact that the State of Arizona requires a solution to its interoperability problem immediately, and the fact that executing all the required actions and securing the funding for a statewide solution will be time-consuming, the PSCC decided to approach the proposed solution from a short- and long-term perspective. Therefore, many of the recommendations of RCC Consultants and imminent plans by individual agencies will be implemented to gain incremental benefits and forge the path to the long-term solution. All short-term efforts will be guided by PSCC-created standards and should be steps toward a statewide solution in terms of technology and operational changes.

Short-term objectives include improvements such as:

- New mutual aid channels
- Improved operational plans and procedures
- Coordinated channel plans
- Expanded coverage areas
- Interconnected network components via microwave system

Long-term objectives aim to achieve improvements such as:

- Seamless interaction among radio systems
- Optimized operational plans and procedures
- Standardized infrastructure approach
- Minimized cross-band issues
- Minimized proprietary technologies

Supporting all of these changes are the operational procedures, partnerships, training, and other non-technology factors that are critical to the success of the initiative. Without substantial improvement in these areas, technological and infrastructure improvements will not reap the potential benefits available to the State of Arizona.

5.3 Conceptual Model of Future State of Communications Interoperability

The future solution for public safety communications that solves the interoperability problem described herein crosses numerous facets, including technology, users and stakeholders, policies and procedures, governance, and support, to name a few. In an effort to convey the operational concept for the future solution, the PSCC developed a conceptual diagram to communicate the common vision for the future. The conceptual model is comprised of three major components which are described below and followed by the model itself.

5.3.1 User Layer

The User Layer depicts the users of the system as well as many of the operational factors that influence or impact communications among the users. Users can be described in a number of ways, but for the purposes of this document they are classified by jurisdiction. Operational factors can be viewed as the range of dynamics that, in aggregate, create unique communication needs for public safety agencies. Operational factors impact the manner in

which the System Layer will be utilized to transmit the appropriate information from the Information Layer.

The intent of communicating these operational factors is to identify major areas of consideration that will need to be thoroughly analyzed when driving detailed requirements for the solution. These factors, and a number of ancillary factors, will ultimately dictate the technical solution, implementation, and cost of the future solution.

5.3.2 System Layer

The System Layer illustrates the infrastructure, spectrum, equipment, and related technologies that should be utilized by the users identified in the User Layer to access the information in the Information Layer. It is intended to encompass the short- and long-term solution that should be funded, designed, procured, implemented, and supported to solve the interoperability problem in the State of Arizona. The short-term solution comprises the incremental improvements generated from the RCC study that are tailored to the specific needs of each Arizona county. The long-term solution is the interoperable solution that includes a standardized infrastructure approach, a minimization of cross-band and proprietary technologies, and seamless interaction among radio systems.

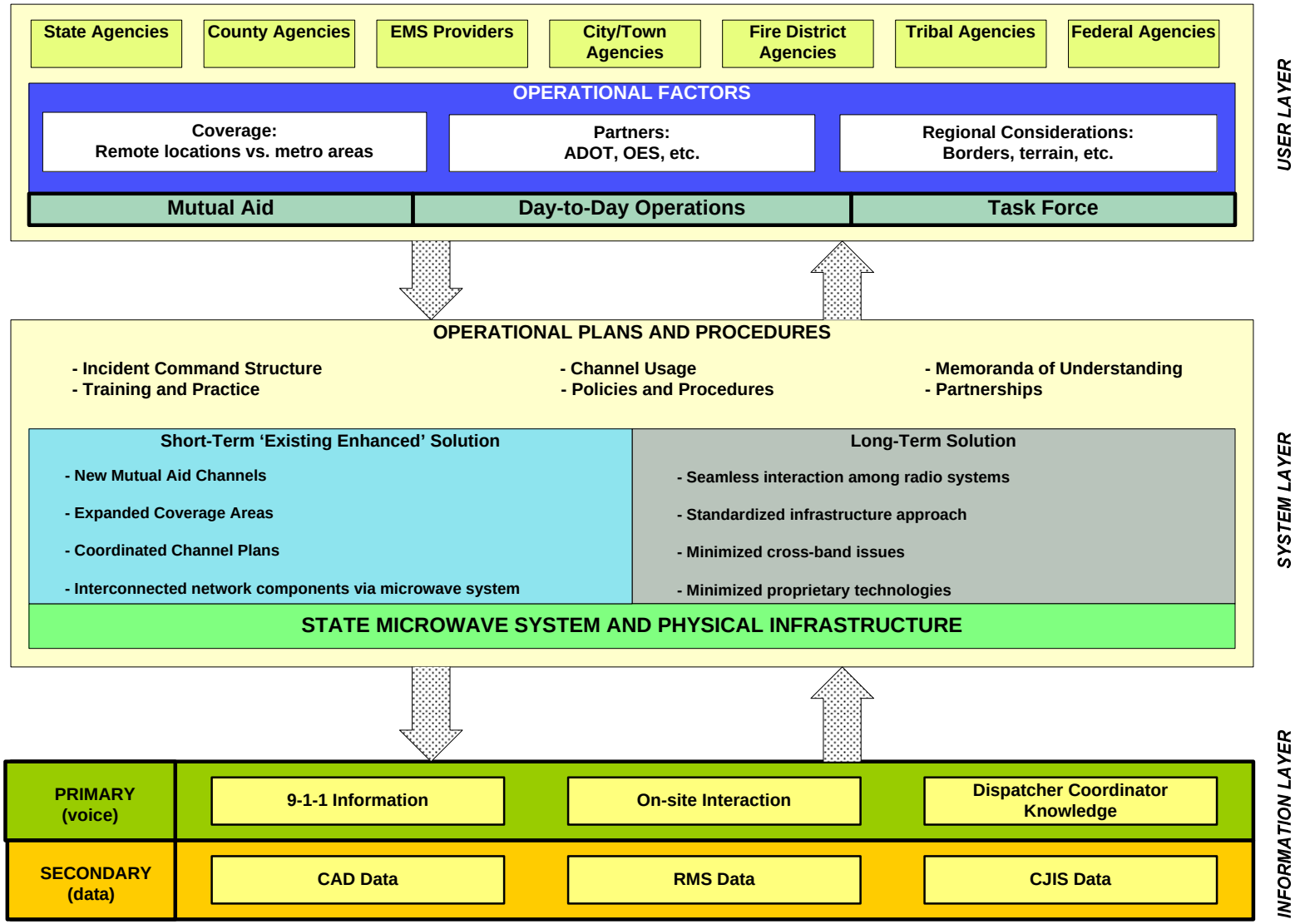
Underpinning the System Layer is the State Microwave System, the backbone or radio operations throughout the State. Furthermore, to highlight the importance of non-technology issues in the System Layer, operational plans and procedures encapsulates the previously noted components. Included in operational plans and procedures are policies and procedures, rules for channel usage, memoranda of understanding between public safety agencies, appropriate training and practice to ensure effective and efficient operations, and partnerships to share physical and human resources.

5.3.3 Information Layer

The Information Layer represents the information that users in the User Layer need to perform public safety duties. The primary information referred to here relates to voice traffic and includes 9-1-1 information, onsite interaction information, and dispatcher/coordinator knowledge. Secondary information focus data from information systems, such as Computer-Aided Dispatch (CAD), Records Management System (RMS) and related systems, Criminal Justice Information System (CJIS) data, and any other system data required to provide public safety within the State of Arizona. Information passes through the System Layer for use by users in the User Layer on an as-needed basis determined by the specific of the incident.

Figure 4 illustrates the conceptual model for statewide interoperability by depicting the layers described above and their respective interrelations.

Figure 4. Conceptual Model of Future Arizona Public Safety Interoperable Solution



5.4 Support Environment

With the introduction of the new operational model presented in the previous section come changes to responsibilities and process. Change management efforts will be significant as people, processes, and technologies will evolve in the future. An area particularly impacted is the support environment for the new solution, for a whole new level of inter-agency cooperation and coordination will be required. New technologies and skills may be required, and the cooperation of support staff across jurisdictions and disciplines will be necessary to support the new model in a cost-effective way. Agencies should benefit from the establishment of PSCC user-based standards and common skill sets which will aid in the ability to lend a supporting hand to partner agencies. Finally, exploration of partnerships with private entities for infrastructure or other support has been employed by other states and may prove to be an effective support model for Arizona.

5.5 Summary of Impacts

The impacts of the proposed solution for statewide interoperability in Arizona are largely beneficial but also carry several disadvantages and limitations. Major impacts are described in the subsections below.

5.5.1 Summary of Benefits and Improvements

The ability to provide better public safety services to the citizens of Arizona and the reduced risk of loss of life and property are the primary benefits and are the driving forces behind the interoperability initiative. However, other major improvements achieved via the proposed solution are as follows:

- **Reduced loss of life and property —** Implementing the required technical, process and procedures improvements will alleviate interoperability issues and reduce loss of life and property in the State of Arizona.
- **Improved coordination and execution —** Collaboration among agencies will be greatly improved by taking a statewide perspective in the development of policies and procedures for coordination and execution of public safety service.
- **Improved use of resources —** The additional resources and methods currently used to address communication issues for first responders will not be required, allowing these resources to be applied to other incidents or activities as required.
- **Enhanced first responder safety —** Removing technology barriers and improving operations through better procedures and increased training will lower the risk of damage, injury or death to first responders.
- **Consistent service across urban and rural areas —** Coverage and interoperability improvements will help improve service in rural areas and close the public safety service gap between urban and rural locations.
- **Lower support costs —** Technology standards and common operational practices will reduce the total support costs and allow for sharing of support resources across agencies.

- **Ability to redirect resources —** As improvements to interoperability are made, first responders will be able to operate more efficiently on incidents and will be able to redirect more time to focusing on the task at hand, thus saving lives and property.

Several key improvements will facilitate the realization of the benefits described above. Key improvements include:

- **Enhanced infrastructure —** Reliability, coverage, support costs, and related issues borne from the aging infrastructure in the State will be fundamentally improved by the proposed solution. In addition, future technological developments (e.g., mesh networks and Internet Protocol-based radio frequencies) can become potential value-added improvements that were previously unavailable options due to the aging infrastructure.
- **Improved training —** In support of the new operational model that will be implemented is the provision of additional and more thorough training in technologies and operations that will better prepare public safety personnel. Additional and improved training reduces inefficiency and risks of loss of life and property.
- **Arizona user-based standards for technology** - Technology standards enhance communication and technology compatibility and can lower the support costs currently incurred by the State.

5.5.2 Disadvantages and Limitations

The disadvantages of the proposed solution center mostly on cost, support, and disruption of current operations. The PSCC and its stakeholders understand the enormity of the interoperability initiative and accept the risks and costs that must be present to provide Arizona with optimal public safety. As such, the primary disadvantages of the proposed solution are:

- **Significant costs and resource requirements —** There is no 'silver bullet' that will solve all of the problems outlined in this document but with funding, a detailed plan for success, and application of resources, the desired outcome can in fact be achieved. However, the one-time and recurring costs for achieving this outcome will be significant and therefore can be viewed as a disadvantage.
- **Risk of loss of momentum due to competing priorities —** Due to the fact that achieving statewide interoperability requires executing many activities over the next eight years, competing priorities and unforeseen events in the future can potentially shift the focus of the interoperability initiative to other issues. Furthermore, individual agencies, jurisdictions, and locations are embarking on similar efforts or have their own competing priorities to contend with. The implementation plan in Section 6 factors in this potential risk and prioritizes activities in a manner that aids in maintaining momentum.

5.6 Critical Success Factors

To achieve the next level for interoperability within the State of Arizona, a number of key activities and milestones must be successfully executed per the implementation plan detailed in Section 6. However, in addition to the execution of tactical and strategic actions to reap the desired benefits of interoperability are critical success factors unique to the statewide interoperability initiative. In an effort to accurately capture and summarize these critical success factors, Gartner polled the PSCC Commissioners to derive a list of the ten most critical success factors that should always be addressed as the PSCC undertakes the path to the long-term solution. The critical success factors in the eyes of the Commissioners and their constituencies:

- Vision and agreement to the Vision
- Plan based on prioritizing high-value projects
- Recruit political leaders capable of being champions
- Commission engagement, tenacity, perseverance, involvement, patience
- Prioritize requests for money and adopt a plan that prioritizes high-value projects
- Buy-in from all of the agencies and associations (Commission should be a representative body)
- Need “quick wins” to show tangible progress and showcase successes
- Show evolution from “quick win” interoperability achievements
- Address interoperability with Tribal Nations
- Communication and education of progress, benefits and achievements

5.7 Key Obstacles

In contrast to the critical success factors presented in the previous section, the PSCC should address key obstacles that may or will impact success to effectively plan the path to a statewide solution. While funding was the unanimous first choice by Commissioners, the other primary obstacles identified were:

- Governance and control/turf wars
- Declining sense of urgency
- Resistance to state instructed projects
- Lack of understanding of problems and critical need
- Securing dedicated and strong leadership
- Lack of standards and range of disparate systems
- Confusion between this project and others
- Geography and terrain

Any and all plans and activities related to the interoperability initiative should keep these obstacles in perspective to be successful. If the State is unable to overcome the major obstacles, interoperability issues will only get worse as the technology ages, and individual agencies make improvements without regard to regional and statewide needs. Consequently, the impacts of remaining with the status quo are significant and damaging to the State of Arizona.

5.8 Summary of Strategy for Achieving Statewide Interoperability in Arizona

Based on the information presented in previous sections and the goals, obstacles, and requirements related to achieving interoperability in the State of Arizona, the overall strategy was developed. The strategy, while uniquely crafted for the specific needs of Arizona, aligns with best practices recommended by industry sources. For instance, it includes all the best practices for interoperability strategy developed by the Public Safety Wireless Network (PSWN) Program (now formally part of SAFECOM). The four major best practices for interoperability

strategy according to PSWN are listed below.

Table 3. PSWN Best Practices for Statewide Interoperability[3]

1)	Cultivate Political and Stakeholder Support
2)	Determine System(s) Planning Requirements
3)	Provide Education to Groups Within the State
4)	Coordinate the Activities of Multiple Agencies and Build Consensus

All of these activities, in addition to other key activities, comprise the strategy for the State of Arizona. The strategy can be summarized on two levels: short-term strategy and long-term strategy. Both components are described below and further described in Section 6, Key Milestones and Implementation Plan.

5.8.1 Short-term Strategy

In the short-term, it is imperative that the PSCC and its constituents aggressively pursue the county-by-county incremental improvements, gain several quick wins that can be actively communicated to stakeholders, and expand the influence of the PSCC itself. Addressing operational policies and procedures immediately, for instance, allows for significant progress while more time-consuming efforts, such as securing funding and procurement activities are executed in parallel. In short, the short-term strategy for the PSCC to pursue during the next two to three years is as follows:

- Publish initial set of user-based standards and guidelines for technology consistent with the long-term strategy for agencies currently implementing changes
- Create a scorecard to assess current interoperability activities occurring throughout the State and in adjoining states
- Complete analyses and other data gathering efforts to feed subsequent next activities of the statewide strategy
- Develop and implement a strategy for defining technical alternatives for the statewide solution
- Establish an education and communications program that defines interoperability, PSCC goals, and the path to the solution
- Develop inventory of subscriber equipment to assist with scoping and funding the future solution
- Develop and implement statewide operational standards
- Aggressively identify and secure dedicated funding source(s)
- Secure short- and long-term legislative support by legislative body
- Assess and implement tactical improvements on a county-by-county basis to achieve quick wins that can be communicated as progress
- Establish/leverage working groups and subcommittees to address operational policies and procedures, governance and ownership, and funding strategies

[3] Source: SAFECOM, http://www.safecomprogram.gov/SAFECOM/

- Encourage opportunities to share communications facilities and infrastructure among agencies

5.8.2 Long-term Strategy

Building off of the achievements and momentum of the short-term strategy, the PSCC should employ a long-term strategy that achieves all of the requirements and objectives described in this document and supporting documentation. Long-term agreements to share facilities and infrastructure, increased cooperation and partnership in provision of public safety, and user-based standards for technology are a few of the long-term strategies that must be achieved. On realization of the long-term strategy, the Mission and Vision of the PSCC will be achieved and public safety agencies within Arizona will finally experience seamless communication when helping the citizens of Arizona. As such, the long-term strategy, which spans years 3 through 8, is comprised of the following:

- Secure long-term funding support
- Define a long-term governance and ownership model
- Pilot interoperable solution based on the new architecture to assess effectiveness and plan for statewide deployment
- Publish full deployment plan and partially deploy statewide, interoperable solution
- Deploy new microwave infrastructure
- Fully deploy statewide, interoperable solution

Specific activities, milestones, durations, and dependencies to support the short- and long-term strategies are described in detail in Section 6. Execution of this two-tiered strategy provides the road map for interoperable communications and the increased protection of life and property in the State of Arizona. However, to realize the strategy and put it into action, the funding strategy in the next section must be carefully and aggressively executed.

5.9 Funding Strategy

The PSCC recognizes that the previously mentioned requirements, issues, and objectives cannot be addressed until a short- and long-term funding strategy can be developed and implemented. Although this will require considerable coordination and effort by the many stakeholders impacted by the interoperability problem, the Commissioners generally feel that funding is achievable and maintainable if diligently and aggressively pursued. To support the funding requirements for the interoperability initiative, the funding strategy should be comprised of or consider the following:

- Multiple funding sources must be applied to the statewide plan to support:
  - Short-term initiative
  - Long-term initiative
  - Ongoing support of the long-term initiative
- Some agencies may need to invest more than others
- PSCC should investigate all options, such as:
  - Homeland security funds

- ❑ Increased taxes/fees (e.g., 9-1-1, satellite users, boat registrations, impact fees on new houses)
- ❑ Pooling current grants/funding
- ❑ Special assessments
- ❑ Debt financing
- ❑ Gaming revenue

An understanding of all current funding streams for agencies, as well as all the potential funding streams available to the PSCC, should be aggressively pursued. Given the competing priorities and dynamic funding needs of all agencies, funding needs and sources must be communicated to the appropriate stakeholders to turn the interoperability vision into a reality.

6.0 Key Milestones and Implementation Plan

Defining key milestones and estimated timeframes for completion must be a concerted effort to perpetuate stakeholder support and to secure funding. The milestones and key activities to achieve the short- and long-term strategy defined in Section 5 are detailed in this section and collectively represent the action plan for the PSCC and its stakeholders to achieve statewide radio interoperability. The milestones and activities were developed by the PSCC to meet the specific needs of Arizona using best practice information from other states as input. For instance, the strategy and plan encompass the aforementioned best practices developed by PSWN.

The table below provides an overview of each milestone, followed by a description of each and the key activities that must be executed to reach that milestone.

Table 4. Key Milestones and Timeframes

	Milestone	Time frame	Notes
1.	Review and adopt the ConOps report	26 July 2005	PSCC should define the overall plan and key milestones to show progress and ensure that its funding continues.
2.	Review the Macro report	26 July 2005	Review Macro Corporation report and present overview to PSCC.
3.	Publish first set of PSCC user-based standards and guidelines for technology	6 months	Already in motion and a major focus of PSCC.
4.	Establish an education and communications program that defines interoperability, PSCC goals, and the path to the solution	6 months	Distribution and presentation of ConOps may be a large component of this activity. Funding source is probably dependent on educational program.
5.	Complete analysis of 15 County short-term, tactical improvement opportunities	6 months	Complete RCC efforts and implement approved recommendations.
6.	Identify short-term funding source(s)	6 months	Secure funding for tactical improvements from RCC.
7.	Create a scorecard to assess current and ongoing interoperability activities occurring throughout the State and in adjoining states	9 months	Assess current activities and plans for achieving interoperability on a county-by-county basis using a developed set of criteria.
8.	Develop inventory of subscriber equipment	1 year	Long-term solution can be scoped and budgeted more accurately if the current environment is captured. Will be part of the final RCC findings.
9.	Implement short-term operational standards	1 year	Using the SIEC to complete, addresses critical need to develop operational procedures and policies beyond the technical components.
10.	Establish technical strategy for achievement of long-term ConOps objectives	2 years	Develop alternatives that meet the requirements defined in the ConOps and supplementary documents. Start with SIEC and other Committee members.

Milestone	Time frame	Notes
11. Implement short-term, tactical recommendations	January, 2007 for initial set, 4 years in total	Achieve short-term wins that will provide a bridge to the long-term solution. Align timing with TOPOFF Homeland Security event (May 2007).
12. Establish governance model and approach to ownership	2 ½ years	PSCC meetings can assist with potential use of subcommittees.
13. Identify long-term, dedicated funding source(s)	2 ½ years	Secure funding for long-term solution; establish working group with DPS as lead to pursue.
14. Pilot long-term, interoperable solution based on new architecture	3 years	Can be pointed to as a success that adheres to solution design and standards set forth by PSCC.
15. Publish full deployment plan	3 years	Achievable if previous activities accomplished in stated timeframes.
16. Deploy new microwave infrastructure	7 years	Critical component of overall solution.
17. Fully deploy statewide, interoperable solution	8 years	Vision and Mission of PSCC achieved.
18. Maintain legislative support by legislative body	Ongoing	Requires assistance from all stakeholders to continually exhaust all relationships and channels to gain support. Garner support for the short-term strategy as well as the long-term.

6.1 Milestone Descriptions

Each of the milestones introduced in Table 4 above are described in more detail along with the key activities that should take place to achieve that milestone.

6.1.1 Milestone 1: Review and adopt the ConOps report

On completion by Gartner, the PSCC should review, comment on, and adopt the plan and recommendations in the ConOps report. This document will serve as the initial planning document that can be updated and revised as the initiative progresses, as the PSCC should define the overall plan and key milestones to show progress and ensure that its funding continues. Once approved, the ConOps should be distributed to all impacted and interested stakeholders to establish a common vision and common terms for the statewide solution.

Key Activities

- Provide additional input (as required) into development of the ConOps
- Review and provide suggestions for change to final document
- Formally approve the ConOps document
- Distribute ConOps to stakeholders and other interested parties

Responsible Parties

- PSCC Support Office
- PSCC

Time Frame

- Complete by 26 July 2005

6.1.2 Milestone 2: Review the Macro report

The PSCC should formally review and assess the content and recommendations resulting from the analysis performed by Macro Corporation. Based on this review, reconcile the content in the Macro report against the overall strategy described in the ConOps document and apply to the interoperability initiative as appropriate.

Key Activities

- Distribute copies of the complete Macro report to PSCC Commissioners
- Solicit feedback from Commissioners on content and recommendations
- Review and comment on Macro report

Responsible Parties

- PSCC Support Office
- PSCC

Time Frame

- Complete by 26 July 2005

6.1.3 Milestone 3: Publish first set of PSCC user-based standards and guidelines for technology

A number of agencies have either begun their own efforts to address interoperability issues or are on the verge of deployment. To ensure that the solutions selected by these agencies adhere to the long-term solution to be defined by the PSCC, a set of standards and guidelines for technology, operational and procurement should be promulgated by the PSCC. Proactively developing and distributing common user-based standards and guidelines for technology will reduce the risk of agencies deploying solutions that preclude options for the long-term statewide solution.

Key Activities

- Solicit input from PSCC Commissioners and other key stakeholders on statewide user-based standards and guidelines for technology
- Develop draft set of user-based standards and guidelines for technology for review and comment by PSCC Commissioners
- Modify set of user-based standards and guidelines for technology as appropriate, formally accept, and distribute to all impacted stakeholders

Responsible Parties

- PSCC Support Office
- PSCC
- SIEC

Time Frame

- Six months

6.1.4 Milestone 4: Establish an education and communications program that defines interoperability, PSCC goals, and the path to the solution

Establishing a common understanding of the interoperability problem and the steps and resources required to rectify the problem will be an ongoing activity for the PSCC. Building from the themes, terminology, and solution approach defined in the ConOps, the PSCC should develop an education and communications program that clearly conveys key information and initiative progress to affected stakeholders and the general public. Distribution of information will be governed by the Communications Plan already developed by the PSCC.

Key Activities

- Confirm goals and objectives of educational and communications program in support of interoperability solution
- Draft curriculum for educational program and proposed educational methods
- Review Communications Plan and update as required
- Present curriculum and Communications Plan to Commissioners for review and approval
- Launch educational and communications program for statewide interoperability

Responsible Parties

- PSCC Support Office
- PSCC

Time Frame

- Six months

6.1.5 Milestone 5: Complete analysis of 15-county short-term, tactical improvement opportunities

In accordance with the strategy in the ConOps, complete the analysis of short-term tactical opportunities that can be implemented as a step toward the long-term solution. Assess individual recommendations to ensure none preclude progression to the long-term solution.

Key Activities

- Complete analysis of all counties with assistance from RCC Consultants
- Assess recommendations and opportunities from a long-term statewide perspective and present action plan to Commissioners
- Establish detailed budget

- Implement appropriate tactical recommendations

Responsible Parties

- DEMA
- DPS Telecommunications Bureau
- PSCC Support Office
- User community
- PSCC

Time Frame

- Six months

6.1.6 Milestone 6: Identify short-term funding source(s)

Identify and secure short-term funding sources for implementation of the short-term tactical recommendations. The total level of funds required will be validated through current analysis efforts. All parties, including the user community at large, should pursue and pool funds to realize the vision of interoperability.

Key Activities

- Develop strategy for identification of funding sources
- Validate total funding required
- Secure funding and apply to appropriate short-term efforts

Responsible Parties

- DEMA
- PSCC Support Office
- User community

Time Frame

- Six months

6.1.7 Milestone 7: Create a scorecard to assess current and ongoing interoperability activities occurring throughout the State and in adjoining states

Assess current activities and plans for achieving interoperability on a county-by-county basis using a developed set of criteria. In addition, ascertain developments in adjoining states and Mexico. Use this information to benchmark State efforts against these activities to track progress and measure adherence to the ConOps strategy as prescribed in Senate Bill 1412.

Key Activities

- Develop a set of criteria to rate the current county-by-county interoperability activities
- Apply criteria to interoperability initiatives in adjoining states and Mexico

- Benchmark State progress against county, adjoining state, and Mexico-based efforts and use as an ongoing measure of progress

Responsible Parties

- GITA
- PSCC Support Office
- User community

Time Frame

- Nine months

6.1.8 Milestone 8: Develop inventory of subscriber equipment

With the assistance of RCC Consultants, develop an inventory of subscriber equipment across the State to better understand the current situation. The long-term solution can be scoped and budgeted more accurately if the current environment is accurately captured. This effort relates closely to Milestone 5 in that the inventory will aid in tactical decisions for the individual counties.

Key Activities

- Conduct data gathering activities with the assistance of RCC Consultants
- Generate inventory of subscriber equipment throughout the State
- Use inventory information to better scope the short- and long-term options and funding requirements for the State

Responsible Parties

- DEMA
- PSCC Support Office
- User community

Time Frame

- One year

6.1.9 Milestone 9: Implement short-term operational standards

Using the SIEC to drive the activities, develop operational procedures and policies beyond the technical components to foster an improved operational model irrespective of the technology decisions made by the State. Adopt an incident command structure based on the NIMS system that is current being developed at the federal level. Develop policies and procedures, training requirements, channel-usage plans, and memoranda of understanding between agencies to support overall interoperability goals.

Key Activities

- Task the SIEC with responsibility of developing operational standards
- Conduct data gathering and analysis activities deemed appropriate by the SIEC
- Present draft recommendations and operational standards to Commissioners for review

and adoption

- On formal approval by the PSCC, distribute operational standards and educate stakeholders in accordance with the education and communications plan developed in Milestone 4.

Responsible Parties

- SIEC
- PSCC Support Office
- User community

Time Frame

- One year

6.1.10 Milestone 10: Establish technical strategy for achievement of long-term ConOps objectives

To understand the technical alternatives available to the State for the long-term solution given its current state, the PSCC should define a strategy for data gathering and analysis of potential solutions. The PSCC should develop a list of alternatives that meet the requirements defined in the ConOps and supplementary documents. Strategy development should begin with SIEC and other Commission members and should subsequently solicit information from other key stakeholders as required.

Key Activities

- Draft data gathering approach and methodology within SIEC
- Vet approach with remaining Commissioners and agree on plan and output
- Conduct data gathering and other germane activities to begin development of distinct alternatives for the State to choose from
- Develop list of alternatives with supporting technology, operations, staffing, and funding information and present to PSCC for review
- Select alternative to pilot as statewide solution

Responsible Parties

- SIEC
- PSCC Support Office
- PSCC

Time Frame

- Two years

6.1.11 Milestone 11: Implement short-term, tactical recommendations

Based on the approved decisions resulting from the achievement of Milestone 5, the PSCC and its constituents should complete the implementation of all the short-term opportunities within four years of accepting the ConOps document. This milestone achieves short-term wins that will provide a bridge to the long-term solution. The timing of this milestone aligns closely with the

TOPOFF Homeland Security event in May 2007. Initial short-term improvements that can be achieved prior to the TOPOFF event will be implemented through January 2007. Once the TOPOFF event is complete, the remainder of the short-term improvements will be executed.

Key Activities

- Prioritize accepted recommendations and opportunities from Milestone 5
- Implement county-by-county recommendations according to prioritized plan
- Assess progress prior to TOPOFF Homeland Security event and communicate results per the Communications Plan

Responsible Parties

- DEMA
- DPS Telecommunications Bureau
- PSCC Support Office
- User community

Time Frame

- Four years

6.1.12 Milestone 12: Establish governance model and approach to ownership

Critical to the interoperability initiative is the governance and ownership of the statewide solution to ensure smooth operation of the future operational model. The model will need to be dynamic as ownership may adapt over time in response to funding developments and the progress of the initiative.

Key Activities

- Explore and assess models used in the past for similar initiatives within and outside of Arizona
- Develop subcommittee to address governance and ownership issues
- Vet pros and cons of different models and develop a shortlist of governance and ownership models for consideration
- Present model alternatives to the PSCC and agree on the short- and long-term model for the statewide interoperability effort
- Formally accept the best method and implement

Responsible Parties

- PSCC
- PSCC Support Office
- User community

Time Frame

- Two and one half years

6.1.13 Milestone 13: Identify long-term, dedicated funding source(s)

Assess current and potential funding streams and strategize to develop a funding plan that supports the plan and requirements contained in the ConOps and supporting documents. Identify resources to pursue funding streams and secure short-term needs in concert with funding strategy for long-term. Funding should be based on two levels: tactical level to support RCC recommendations and long-term to support the Macro report. It is recommended that a working group or subcommittee is established with DPS as lead to ensure funding is secured.

Key Activities

- Develop working group or subcommittee to develop short- and long-term funding strategy
- Assess recommendations in RCC and Macro reports and prioritize to fuel funding strategy
- Ascertain current funding applied to interoperability as well as other real or potential funding streams available to the State
- Define strategy and tactical activities to fund short- and long-term solution and present to PSCC for review and approval
- Secure required funds per approved funding strategy and plan

Responsible Parties

- Legislative Support
- PSCC
- PSCC Support Office
- User community
- GITA

Time Frame

- Two and one half years

6.1.14 Milestone 14: Pilot long-term, interoperable solution based on new architecture

On completion of previous steps, the PSCC should procure and implement a pilot of the long-term solution based on the technology, operational, and related decisions made by the PSCC and its constituents. Assess the successes and issues with the pilot for inclusion in the overall deployment plan for the statewide interoperable solution.

Key Activities

- Define criteria for selection of appropriate pilot site(s)
- Determine scope and objectives of pilot
- Procure and implement appropriate products and services to establish and operate the pilot
- Assess results and use as input into statewide deployment plan

Responsible Parties

- PSCC
- PSCC Support Office
- DPS Telecommunications Bureau
- User community
- GITA

Time Frame

- Three years

6.1.15 Milestone 15: Publish full deployment plan

Leveraging the results of the pilot in Milestone 14, define a complete, statewide deployment plan based on input from the PSCC Commissioners and their constituents. Align the deployment plan with operational and process changes as well as the funding strategy previously defined and accepted by the PSCC. Publish the deployment plan to prepare all stakeholders for the timelines and resource requirements required to execute the plan.

Key Activities

- Evaluate results from the pilot and include in deployment plan
- Align funding strategy, operational improvements, and other contingent efforts with deployment plan
- Define draft deployment plan using subset of PSCC and present for discussion to PSCC
- Finalize and formalize the deployment plan and communicate per the Communications Plan

Responsible Parties

- PSCC
- PSCC Support Office
- User community

Time Frame

- Three years

6.1.16 Milestone 16: Deploy new microwave infrastructure

Procure and deploy a new microwave infrastructure to support the long-term solution and align pilot and deployment planning activities in Milestones 14 and 15. Secure funding and define implementation plan in accordance with overall interoperability plan. The deployment of the new microwave infrastructure will be executed in three phases that correspond with the three-phase deployment of the statewide, interoperable solution described in Milestone 17.

Key Activities

- Define requirements for new microwave infrastructure with appropriate stakeholders
- Procure infrastructure and develop implementation plan with selected vendor(s)
- Implement microwave infrastructure in accordance with overall plan and attention to pilot and statewide deployment plan

Responsible Parties

- DPS Telecommunications Bureau
- PSCC Support Office

Time Frame

- Seven years

6.1.17 Milestone 17: Fully deploy statewide, interoperable solution

On achievement of all the previous milestones and full execution of the statewide deployment plan, the mission and vision of the PSCC will be realized. Deployment of the statewide interoperable plan will be executed in three phases that correspond with the deployment of the new microwave infrastructure. Phases will overlap with the microwave deployment in a manner that allows the infrastructure to be deployed to an appropriate level prior to implementation of the technology and operations changes that comprise the statewide solution. Focus will change to the ongoing monitoring and maintenance of the new solution as interoperability among public safety agencies will have been achieved to the benefit of the agencies and the citizens of Arizona.

Key Activities

- Deploy interoperable solution to all sites on the deployment plan
- Shift focus to ongoing monitoring and maintenance and develop plans accordingly
- Perform a post-implementation review to assess results and make necessary adjustments.

Responsible Parties

- DPS Telecommunications Bureau
- PSCC Support Office
- User community

Time Frame

- Eight years

6.1.18 Milestone 18: Maintain legislative support by legislative body

Using the momentum that spurred the formal creation of the PSCC, a well-defined plan for interoperability and short-term achievements should be effectively communicated to the legislative body. Funding support and championing of the interoperability initiative from the legislative level will be directly impacted by the effectiveness of this milestone. Assistance from all stakeholders is critical to ensuring that all possible relationships and channels have been

aggressively pursued to gain support.

Key Activities

- Develop strategy based on relationships and power structure to gain broad support for the interoperability initiative
- In concert with the Communications Plan, define approach to disseminating information to the legislative body
- Define short-term achievements that can be accomplished to exhibit progress of PSCC
- Target appropriate legislators for support in obtaining funding

Responsible Parties

- PSCC
- PSCC Support Office
- User community
- GITA

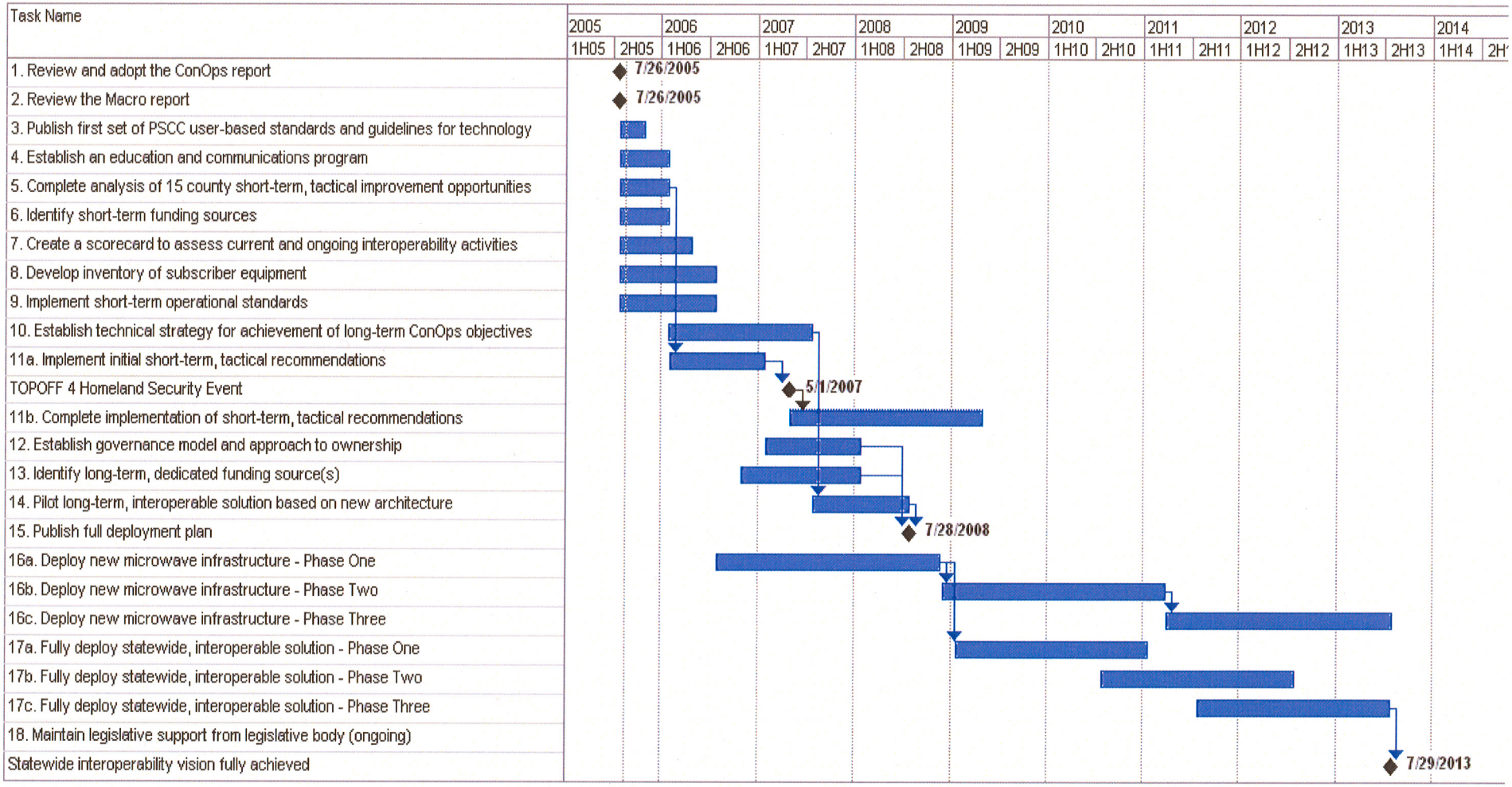
Time Frame

- Ongoing

6.2 Statewide Interoperability Project Plan

The project plan on the following page combines all of the efforts detailed in the previous section into an aggregate project plan that can be maintained throughout the life of the initiative. High-level dependencies and relationships between milestones are indicated but each milestone will require additional analysis and most likely its own project plan.

Figure 5. Arizona Statewide Interoperability Project Plan



Appendices

Appendices

Appendix A — After-Action Reports and Scenarios Illustrating Interoperability Issues

An effective way to convey the impacts and magnitude of interoperability issues is through the provision of real-life examples that have occurred within the State of Arizona. Coupled with operational scenarios that address situations that have not been commonly experienced in the State, these real-life scenarios drive home the criticality of solving the interoperability problem without requiring intimate knowledge of the technologies or operations of public safety agencies. A brief description of several key incidents and scenarios is provided below to further highlight the interoperability issues facing Arizona.

A1. Arizona Bi-national Exercise

In November 2003, the Arizona Department of Homeland Security conducted a Bi-National Weapons of Mass Destruction Exercise involving the four border counties and Mexican emergency agencies. The goal was to address the State's weakest point in terms of vulnerability to terrorism, since emergency services personnel from both nations are unable to communicate through normal emergency radio communications means.

To conduct the exercise, a wide-area network solution was created to provide connectivity to the exercise interoperability equipment and to link all principle U.S. and Mexican emergency agencies in Nogales. The ACU1000, a microprocessor-based link between multiple radio products and frequencies, was employed as part of the solution. Requisite training, coordination meetings, communications planning, and mobile interoperability equipment were included to fully prepare the agencies involved for interoperability during an incident involving weapons of mass destruction.

On completion, the exercise was deemed a success in terms of the performance of this communications interoperability solution, providing a clear example of the benefits of interoperability in a real-world scenario. However, it became clear the technical aspects of interoperability are not the only concerns and operational factors were the biggest challenges. One participant listed as a key weakness the "poor communication between players" and noted a "need for more planning." In addition, there were some technical issues as well as participants could not use radios to communicate with personnel at the site, leading one participant to comment that "radio communication needs improvement."

A2. Pinal County Weapons of Mass Destruction/Chemical Terrorism Exercise

In November 2003, Pinal County Office of Emergency Management (PCOEM) conducted a Weapons of Mass Destruction (WMD)/Chemical Terrorism Exercise. The exercise was co-sponsored by the state of Arizona Department of Emergency Management (ADEM) and the U.S. Department of Homeland Security, Office of Domestic Preparedness (DHS/ODP). The full-scale exercise operation lasted six hours, consisting of the representatives/responders from thirteen local, tribal nation, county and private agencies at the scene and fourteen agencies in the Pinal County Emergency Operations Center.

The major successes of the exercise were in the realm of cooperation and participating efforts from agencies of local, tribal nation, county, state and private level responding to a WMD chemical terrorism/emergency event. Initial control, planning and entry by participants at the

scene were also considered strengths. However, the weaknesses identified included weak standard operating procedures/guides for a multi-agency response, training gaps, lack of additional communications frequencies, and a strong need for interoperability communication for a multi-agency response.

A3. Holbrook Police Department/Navajo County Sheriff Incident

On the evening of New Year's Eve, December 31, 1988, Navajo County Sheriff's Department (NCSD) Deputy Bob Varner was shot and mortally wounded while stopping a car in Winslow. After the shooter fled, Holbrook Police Department (HPD) and NCSD officers set up a roadblock entering Holbrook and DPS officers drove west from town in an attempt to locate the vehicle.

An officer from the HPD followed about one minute behind the DPS officers. Unknown to the DPS officers, the suspect turned through the median and opened fire on the HPD officer right after the DPS officers passed. While the officer was not hit, he ran off of the road and was forced to hide in the bushes to escape the gunfire.

As the DPS officers tried to locate the suspects from the original shooting, they passed back and forth past the HPD car, unaware it had been involved in a shooting. It was not until 20 minutes later that a NCSD deputy stopped with the HPD car and discovered it was riddled with bullet holes. The NCSD deputy called for help at the Holbrook shooting scene which brought the involved agencies to the location.

At this same time, NCSD deputies began a pursuit off of the freeway just yards away, with the suspects shooting at them. DPS officers attempted to catch up to the pursuing officers, but had no way to communicate with them. After stabilizing the scene, DPS officers attempted to direct the agencies in the area to coordinate a search. With no common communications, any call for information had to be relayed from officer to dispatcher to dispatcher to officer. To coordinate communications, there were times when an officer had to physically move from officer to officer to ensure the same information was being shared.

A4. Payson Domestic Violence Incident

In May of 2005, a violent domestic violence incident occurred, during which a man threatened to kill his girlfriend and himself. Fortunately, the girlfriend was able to escape with a handgun and call 911 for help. Officers responded and eventually requested help from two DPS officers to establish a perimeter. While DPS uses the UHF for radio communications, Payson police utilize VHF radios. The DPS officers did not have interagency capabilities on their portables, and would likely have had technical issues communicating with the nearby Mount Ord tower anyway.

As a result of the communications issues, the DPS officers were forced to remain within earshot of the Payson officers, extremely limiting the ability to utilize personnel effectively. As the situation developed, Payson PD was able to deliver a portable radio to one of the DPS officers as a partial solution and the issue was resolved without tragedy. However, it is clear the overall effectiveness of the dual-agency response was severely impacted by lack of interoperability.

A5. Cross-jurisdictional Pursuits

DPS frequently has interoperability issues in northwest Arizona related to pursuits initiated by Kingman Police Department which end up on I-40. Radio communications do not cover remote locations with the exception of approximately 10 miles outside Kingman. Often Kingman police officers will request DPS backup for a pursuit as the suspect gets on highway. Once a DPS

officer gets involved in the pursuit, the Kingman police attempt to let DPS become the primary unit by calling their dispatch, who subsequently calls DPS dispatch, who in turn radios the DPS officer.

This process engenders time delays that impact the ability to provide optimal support and any information that needs to be passed on. Information from the Kingman police to DPS is transmitted in the same fashion until Kingman police can no longer reach their dispatch, at which point, officers often must revert to hand signals between each other to communicate. When a vehicle must be "spiked," officers often do not know what someone from another agency is doing and police vehicles have been spiked several times due to lack of communications.

A6. Buckeye Prison Hostage Incident

During a fifteen-day hostage situation at the Buckeye prison Lewis complex in January 2004, DPS was unable to communicate directly with any of the on-scene units, which included Maricopa County Sheriff's Office (MCSO), the Federal Bureau of Investigation (FBI), the Department of Corrections (DOC), and the Phoenix, Glendale, Scottsdale, Buckeye Police Departments. The communications limitations hindered operations and coordination and forced agencies to co-locate a representative in the same room just to conduct radio communications.

Messages had to be communicated to all agencies that were actively involved in the incident, which proved to be a big problem due to the scope of this operation. In fact, every large-scale or multiple jurisdiction situation requires sharing radios to communicate with the various agencies involved. Day-to-day SWAT operations cannot communicate with a SWAT operator that may be standing three feet away unless officers use car-to-car mode. The standard practice of recording conversations of SWAT team officers is limited by the technology available today.

A7. Traffic Accident/Helicopter Landing Incident

On the evening of October 16, 2004, two police officers responded to assist DPS West Valley units with a head-on fatal collision on the eastbound Interstate 10 ramp. During the first few minutes of the preliminary investigation, there were several fire departments attempting to coordinate a landing zone for medical helicopters for the victims. There were communication difficulties between the DPS Incident Commander, the Fire Department Battalion Commander, and the medical helicopters.

As a result, information was not relayed to the helicopters from the fire department in a timely manner, which resulted in a helicopter attempting to land in an area that was not blocked off for traffic. The rotors nearly struck the barrier walls for the single lane ramp and one DPS officer and three Avondale firefighters, approximately 100 feet from where the helicopter attempted to land, had to use a fire truck for cover. The helicopter did not land but remained over the scene for a few minutes and then was canceled when all patients were transported by ground ambulance.

During a debriefing with fire and DPS personnel, it was learned several fire department personnel had direct radio contact with the medical helicopters, but these individuals evidently had not communicated with the fire ICS commander because the DPS Incident Commander had clearly advised all DPS units and DPS communications of where the landing zone was set up.

A8. Deer Valley Airplane/Semi-tractor Trailer Collision

On April 13, 2005, a Cessna airplane collided with a semi- tractor trailer on Interstate 17 in Deer Valley. The collision scene extended approximately one-half mile and involved a number of agencies, including DPS, Phoenix Police Department, Arizona Department of Transportation, National Transportation Safety Board, Federal Aviation Administration, and the Department of Environmental Quality (HazMat).

DPS had jurisdiction of the collision scene and instituted a unified command with the involved agencies. Due to the length of the scene and number of personnel involved, communication was extremely difficult and most communication occurred face- to-face or by cell phone. This incident would have been expedited from first response to final investigation if agencies would have had the ability to talk with other agencies via a common radio frequency.

A9. Rodeo-Chediski Fire/Coconino County Sheriff's Office Communications

In June 2002, the Rodeo-Chediski fire ignited and eventually consumed 462,159 acres of land, burning its way into the history books as the largest wildfire ever in Arizona. Numerous public safety agencies responded to the incident and ultimately experienced significant interoperability problems that negatively impacted their ability to perform the required duties. Core to the problem was too many units attempting to talk on the designated interagency channel, thus creating significant communications issues. In response to these issues, officials established separate frequencies for the incident. There were two frequencies used for the east side of the incident and one for the west and neither worked below the rim on the reservation portion of the fire.

Among other interoperability issues, most of Maricopa County Sheriffs Office (MCSO) units were on 800 MHz frequencies and there was no way for them to communicate unit to unit. Their range was limited in the mountainous region, and personnel did not have enough portable radios to alleviate the problem. This caused a lack of flexibility in assignment for MCSO personnel that limited the effectiveness of the personnel. Compounding the situation, incident and local fire departments were on different frequencies than law enforcement, leaving law enforcement personnel unable to receive fire information. Portable radios were reprogrammed to include all incident frequencies and local fire department frequencies along with law enforcement frequencies. This allowed for units to scan all frequencies to know what was going on but was not the optimal solution for a situation such as this.

Additionally, interoperable communications was negatively impacted by a nonfunctioning tower in the middle of the fire. During the incident, personnel learned which locations could not be used and repeaters were employed to address this communications gap. As a result, direction and conversations with supervisors and deputies were not timely, and actions were delayed. Finally, local agencies could not talk with DPS units due to DPS being on UHF interagency that is linked only on mountain tops. This issue was never resolved, so other agencies only talked with DPS face-to-face once daily, causing some problems and numerous misunderstandings.

Other documented issues include:

- Cell phone coverage was busy due to the increase in both incident and public traffic. A temporary solution provided cell coverage for the west side of the fire, but only improved communication between incident personnel.
- Communication through satellite phones was also impacted, mainly due to problems

with smoke that caused calls to be dropped.

- County Emergency Management was unable to reach State Emergency Management and the Incident Command Center, sometimes for days at a time, due to heavy land-line phone traffic.
- At times, the Incident Command Center couldn't talk to local fire departments due to cell phone and land-line problems.

This well-publicized incident highlights a number of the critical interoperability deficiencies illustrated in this document, including terrain-related, technological, and operational issues. The statewide interoperable solution described in the ConOps document must be pursued in order to more effectively respond to the next incident that will ultimately put Arizona citizens and property at risk.

Appendix B — Current PSCC Commissioners

The current list of active PSCC Commissioners is documented in the table below. In addition to the Commissioner's respective names, titles, and agencies represented, the term expiration date is provided for each Commissioner.

Table 5. Current PSCC Commissioners

Name	Title and Agency	Term Expiration
Roger Vanderpool*	Director, Arizona Department of Public Safety	N/A
Ray W. Allen	Assistant Chief, Tucson Fire Department	1/1/2007
Amy Brooks	Captain, Apache Junction Fire Department	1/1/2009
Hal Collett	Sheriff, La Paz County/Arizona Sheriffs Association	1/1/2008
Gordon Gartner	Chief, Payson Police Department	1/1/2008
Jan Hauk	President, Arizona Fire District Association/Buckeye Valley Fire District	1/1/2009
Richard Miranda	Chief, Tucson Police Department	1/1/2008
Tracy L. Montgomery	Commander, Phoenix Police Department	1/1/2007
Kathleen Paleski	Commander, Northern Arizona University Police Department	1/1/2009
Daniel Sharp	Chief, Oro Valley Police Department	1/1/2009
Lou Trammell	Deputy Director, Division of Emergency Management	1/1/2007
Dan Wills	Battalion Chief, Sedona Fire District	1/1/2007
Kenneth Witkowski	Chief, Gila River Indian Community Police Department	1/1/2007
Dewayne Woodie	Fire/EMS Captain, Ganado Fire District	1/1/2008
Michael Worrell	Captain, Phoenix Fire Department	1/1/2008

* Chairman

Appendix C — Overview of Key Components of Current State of Communications in Arizona

An overview of the existing public safety operations in the State of Arizona that depend on mobile radio systems relevant to the future solution is provided below. The tables on the following pages highlight key elements of the existing mobile radio system configurations, frequency bands, functions, and maintenance support. This information is a summary of the information presented in the aforementioned Macro Corporation report.

Table 6. Current Mobile Radio Systems by Jurisdiction

Jurisdiction	Description of Current State
State	■ Departments own and operate numerous private mobile radio systems ■ Approximately 57 remote telecommunications sites throughout Arizona ■ All Department systems share same sites as one common infrastructure ■ DPS Highway Patrol has the largest system consisting of 52 repeater sites and three dispatch center locations
County	■ Each of the counties in Arizona owns and operates a private land mobile radio system ■ Systems generally service Sheriff's Office, Fire Departments, EMS, Corrections, Courts, Probation, Animal Control, County Roads and Public Works ■ Each system generally consists of a number of repeater sites linked back to a county dispatch, commonly located at the Sheriff's Office ■ Some additional systems for local police and fire departments operate on the County system
City/Town	■ Generally provide communications for Police, Fire/EMS, rural Fire Districts, and Animal Control ■ Operates one-radio system or a separate radio system for each agency ■ Public Works operates on public safety systems or has its own system ■ Vary from a single site with a single channel to the latest Project 25 compliant 800 MHz digital-trunking systems using simulcast technology
Fire District	■ Approximately 138 fire districts responsible for Fire, EMS and Rescue services in small towns and the surrounding rural areas ■ Employ single-channel, single-site repeaters although some have multiple sites ■ Most connect repeaters to a dispatch service that is dedicated or operated by the county or local police department
Tribal Nation	■ Operate mobile radio systems for Police, Fire/EMS, Housing, and Public Works ■ Most systems belong to Tribal Nations but others provided by Bureau of Indian Affairs (BIA) ■ Police and Fire/EMS systems are sometimes the same and sometimes two independent systems
Federal	■ Includes FBI, DEA, ATF, BLM, BIA, INS, NPS, Border Patrol, U.S. Forest Service, United States Marshal Service, Secret Service, and Customs ■ FBI and DEA use fixed repeaters supported by a microwave backbone over a large portion of the State ■ Border Patrol, INS and Customs have unique requirements along the border with Mexico ■ ATF has fixed infrastructure in the larger metropolitan areas and install on a case-by-case basis for the remainder of the State

Table 7. Current Subscribers by Jurisdiction

Jurisdiction	Description of Current State
State	■ Approximately 7,591 personnel have either a mobile radio or portable or both that need to communicate with a network ■ An estimated 6,073 use their radio on a regular basis ■ Does not include mobiles/portables that do not communicate to a network
County	■ Approximately 1,482 users in all Sheriff's Offices ■ Approximately 5,000 Corrections employees but only a small number use mobile radios outside the institutions ■ Emergency Medical Services (EMS) operates in one of three fashions; as a separate ambulance service, part of the Fire Department, or is contracted to private provider
City/Town	■ Approximately 8,196 sworn officers, of which 5,580 are in Maricopa County and 1,162 are in Pima County ■ Vary from as few as five to thousands in the metro Phoenix area
Fire District	■ Approximately 5,000 full-time equivalent firefighters and 6,000 firefighters in total ■ An estimated 3,700 are employed by the larger Fire Departments, and the remaining 1,300 by the 138 Fire Districts
Tribal Nation	■ Approximately 730 sworn Tribal Nation police officers in Arizona, not including federal BIA officers ■ Vary in size from the Navajo Department of Public Safety at 321 sworn personnel to Quechan Tribal Nation Police with 6 officers
Federal	■ Approximately 1,500 Federal subscribers ■ Number can vary considerably depending on the active caseload being serviced by FBI, DEA or ATF agents

Table 8. Current Coverage by Jurisdiction

Jurisdiction	Description of Current State
State	■ Generally regarded as inadequate, county or municipal systems and cell phones are used to compensate for the lack of coverage ■ Not designed for portable coverage despite need for in-building portable coverage
County	■ Coverage varies from less than 50 to 95% ■ Portable coverage ranges from 10–80%; inadequate mobile coverage ■ Most Sheriff's Offices report in-building coverage problems ■ Generally do not provide coverage in accordance with the Telecommunications Industry Association (TIA) TSB-88A standard
City/Town	■ Coverage varies from 50–95% ■ Even in those towns with 95% coverage, Fire and EMS vehicles often respond up to 40 miles beyond the town limits to the point where no coverage exists ■ Most systems were designed more than 30 years ago when only mobile coverage was a requirement resulting in poor portable coverage for today's needs ■ In-building coverage is poor to non-existent
Fire District	■ Variance by agency is very wide, ranging from less than 50% to 95% ■ Coverage within the towns that are the responsibilities of the Fire District have reasonable coverage ■ Dramatically reduced or non-existent coverage outside the town limits ■ Wide-area portable coverage is generally very limited
Tribal Nation	■ Coverage varies 60–90% ■ Portable coverage is generally poor with some Nations reporting less than 20%
Federal	■ FBI and DEA do not have public safety grade coverage throughout the State of Arizona; however, they can deploy transportable systems where it is deemed that enhanced coverage is required for the case ■ Permanent portable coverage for agents is a by-product of the mobile coverage and whatever is available is accepted ■ Some agencies, such as the U.S. Forest Service, operate with a fixed infrastructure

Table 9. Current Frequency Bands by Jurisdiction

Jurisdiction	Description of Current State
State	■ Makes extensive use of the VHF and UHF bands with a limited amount of 800 MHz for ADOT in Maricopa County, and an MDT system for DPS
County	■ All county mobile radio systems in Arizona operate on wideband VHF, except the following: ❑ Cochise — VHF (Narrowband) ❑ Greenlee — UHF (Wideband) ❑ Maricopa — 800 MHz Trunking ❑ Pima — 800 MHz Trunking
City/Town	■ Most systems in the cities and towns of Arizona operate in the VHF frequency band, although 8 operate in the UHF band, of which 5 are in Maricopa County
Fire District	■ Most operate in the VHF frequency band using wideband channels, although some operate in the UHF band
Tribal Nation	■ Systems operate in the VHF, UHF and 800 MHz bands and some systems are owned by the BIA and operate in the federal frequency bands
Federal	■ Systems operate in the VHF or UHF bands ■ Most systems are wideband; however, there is a plan to convert to narrowband operation by 2005 for VHF and 2008 for UHF ■ The U.S. Forest Service system in Apache-Sitgreaves National Forest is already operating narrowband

Table 10. Current Traffic Capacity by Jurisdiction

Jurisdiction	Description of Current State
State	■ With the exception of the DPS Highway Patrol and Criminal Investigations (CI) systems, no state departments have reported traffic in excess of system capacity ■ ADOT is approaching the limit of its VHF system ■ Regarding DPS systems, it is very difficult to examine the overload; however, it is generally believed that DPS systems are most likely overloaded
County	■ Only Pinal County has reported a lack of adequate channels to meet its traffic requirements ■ Yavapai County is at the limit of its channel capacity
City/Town	■ Adequate channel capacity with the exception of Avondale, Bullhead City, Coolidge, El Mirage, Eloy, Oro Valley, Page, Parker, Peoria, Prescott, Prescott Valley, Quartzsite (shared), Williams, and Winslow
Fire District	■ One channel is adequate since mobile radio traffic is very light due to small size of the agencies
Tribal Nation	■ Channel capacity not an issue ■ Dispatch Centers are understaffed giving the appearance of a lack of channel capacity
Federal	■ The U.S. Forest Service and Border Patrol are overloaded and are in need of additional channels which are not available. ■ No other issues reported by other federal agencies

Table 11. Current Interference by Jurisdiction

Jurisdiction	Description of Current State
State	■ Most of the interference in Arizona occurs in the VHF band ■ Large user groups like DPS and EMSCOM in the UHF band experience very little, if any interference ■ DPS officers "talk over" each other and this is often described as interference ■ ADOT and Game and Fish operate in the VHF band tend to operate interference free; Game and Fish occasionally gets some interference from Mexico
County	■ Apache, Coconino, La Paz, and Pinal Counties regularly experience co-channel interference into one of their repeaters ■ Yavapai County has a severe intermodulation problem at one of its repeater sites involving Mesa PD ■ Interference is most prevalent in the VHF band; however, the amount of interference to county systems in Arizona is nominal
City/Town	■ Most cities and towns operating in the VHF band experience some interference, usually from other public safety agencies ■ Many agencies in the VHF band also reported interference from Mexico ■ Cities/towns in UHF or 800 MHz band largely free of co-channel interference ■ Some of the 800 MHz systems experience interference related to Nextel's rotating of frequencies in response to demand for services
Fire District	■ Experience some degree of co-channel interference related to interference in the VHF frequency band
Tribal Nation	■ Interference is a common problem for Tribal Nation systems in the VHF and UHF bands
Federal	■ Operate in the federal portion of the radio spectrum experience no interference issues

Table 12. Current Dispatch Centers by Jurisdiction

Jurisdiction	Description of Current State
State	■ Function with a variety of 24/7 dispatch services, the most formal being the three DPS Dispatch Centers, ADOT's Traffic Operations Center, Game and Fish, Department of Corrections, Department of Agriculture and State Lands ■ Many state agencies can access their repeaters with a local control station ■ In general, all repeater traffic from any agency is carried on the DPS microwave network to DPS Headquarters in Phoenix ■ An incident with the Phoenix Microwave Room or the associated tower would have a devastating and long-term effect on all state communications as there is not redundancy or backup in the event of central failure
County	■ Generally each county operates on a 24/7 basis a dispatch center located in the city designated as the county seat ■ Counties typically dispatch for the Sheriff's Office and provide mobile services to Corrections and probations officers ■ Dispatch services are also often provided for local Police and Fire Departments, EMS, Courts, and Animal Control operating within the County
City/Town	■ The majority operate their own 24/7 dispatch centers, usually in conjunction with a primary public safety answering point (PSAP) ■ A few agencies use the County radio system and Dispatch/PSAP services ■ Some towns share Dispatch and PSAP services and use a common radio system ■ Arizona has a very large number of PSAP's and Dispatch Centers in comparison to the low population outside the major metropolitan areas
Fire District	■ Dispatch falls into three categories: ❑ Fire District has its own Dispatch Center ❑ Fire District is dispatched by County Sheriff's Office Dispatch Center ❑ Fire District is dispatched by local Police Department
Tribal Nation	■ Operate dispatch centers for Police, Fire/EMS, Housing and Public Works ■ Some Dispatch Centers also serve as the primary PSAP for the Tribal Nations, while in other cases the County PSAP is the primary ■ Not all Tribal Nation Dispatch Centers operate on a 24/7 basis ■ Many homes (50%) on the Tribal Nation lands do not have a fixed landline telephone in their residence, which precludes 9-1-1 calls
Federal	■ The FBI, DEA, BLM, NPS, INS, Border Patrol, Customs, and U.S. Forest Service operate Dispatch Centers in Arizona ■ Most Federal agencies also have fixed control stations at their office locations, which can access the repeaters

Table 13. Current Microwave Linking by Jurisdiction

Jurisdiction	Description of Current State
State	■ Extensive analog microwave network throughout Arizona carries mobile radio and telephone voice traffic for State Departments ■ All mobile radio traffic from each remote site is backhauled to a Dispatch Center on the statewide microwave network ■ Microwave backbone is configured as three baseband switched rings; although, there are numerous spur routes ■ Microwave links operate in the 2 GHz, 6 GHz, and 10 GHz bands. In addition, there are some 450 MHz and 900 MHz point-to-point links used for control and audio ■ The State also has three links of digital microwave to support the ADOT 800 MHz mobile radio trunking system in Maricopa County ■ The backbone microwave system installed capacity is 480 channels, and some traffic other than that of the State, such as federal law enforcement, is carried on the system
County	■ Most counties in Arizona use radio frequency control links or leased wireline to control the mountain top repeaters; however, there are two exceptions, as follows: ❑ Cochise County has some microwave infrastructure and is planning for additional equipment to support the new VHF narrowband system ❑ Maricopa County has a redundant optical carrier level 3 (OC3) microwave ring infrastructure for backhaul of all the mobile radio traffic ❑ Coconino County has some microwave infrastructure that connects to the DPS network
City/Town	■ Microwave backhaul is a standard feature of the new 800 MHz trunking systems presently being installed for the cities of Phoenix, Mesa, and Gilbert Police Departments and the Phoenix Fire Consortium ■ A few other cities and towns have a microwave infrastructure, such as Avondale, Bullhead City, and Casa Grande
Fire District	■ Most of the Fire Districts do not own or operate any microwave infrastructure; although, there are exceptions, such as the Sedona Fire District
Tribal Nation	■ Tribal Nation mobile radio systems do not use microwave for their backhaul infrastructure
Federal	■ The FBI and U.S. Forest Service (National Forests) operate a microwave network to support their mobile radio systems in Arizona

Table 14. Current Security by Jurisdiction

Jurisdiction	Description of Current State
State	■ DPS Highway Patrol uses cell phones to transfer sensitive information to other law enforcement agencies and other areas within DPS ■ Law enforcement typically uses voice encryption or encrypted data transmission for this task
County	■ Some counties are using cell phones and alphanumeric pagers to compensate for the lack of encrypted voice ■ County law enforcement requires a means to communicate sensitive information and for use by special task forces
City/Town	■ Monitoring is a major issue for all Police Departments in the West Valley, as all, some criminals and citizens have full monitoring capability
Fire District	■ Currently do not use and do not see a need for encrypted radio communications ■ There are instances where addresses, victim's names and other sensitive information must be broadcasted over the air
Tribal Nation	■ No encryption, however some Nations are using cell phones to serve warrants, which is a dangerous practice for law enforcement
Federal	■ Extensive use of encryption technology ■ Many agencies are presently using analog encryption, which provides unsatisfactory coverage and audio quality

Table 15. Current Reliability by Jurisdiction

Jurisdiction	Description of Current State
State	■ No reliability statistics maintained ■ However, it is believed that the Highway Patrol system reliability is considerably below the standard usually accepted for public safety
County	■ Poor system reliability is a big issue with some counties ■ In many cases, the infrastructure equipment is old and subject to frequent failure In other cases, poor system reliability is resulting from design issues with simulcast or radio equipment ■ The reliability of leased wireline facilities used extensively for repeater control is also plaguing some counties
City/Town	■ In general, reliability is average to good with some exceptions ■ There are some severe simulcast design issues and some equipment is very old resulting in reliability issues
Fire District	■ Reliability has a wide variance ■ The age of the infrastructure equipment varies from almost new to more than 20 years old
Tribal Nation	■ Reliability is a big issue with some Nations ■ Some of the mobile radio system infrastructure is very old and maintenance is poor, resulting in poor reliability ■ Some Tribal Nation systems do not have standby AC power at their repeater sites, which often results in loss of a repeater or the total system
Federal	■ Reliability is not an issue for most federal agencies operating in Arizona ■ Exception is the National Park Service (NPS) which operates old antiquated radio equipment, that is unreliable and requires frequent maintenance

Table 16. Current Maintenance by Jurisdiction

Jurisdiction	Description of Current State
State	■ The DPS Telecommunications Bureau maintains all mobile radio systems and the associated infrastructure designed to meet the needs of various departments of the State ■ DPS maintenance response and performance are largely considered good but outage reports of repeaters, microwave, power, etc., show some issues
County	■ Outsourced to private industry with the exception of Apache, Cochise, Maricopa and Pima ■ Some counties are not very satisfied with the maintenance response or performance obtained from private industry ■ Perception that there is a lack of qualified telecommunications maintenance personnel in some areas of the State of Arizona
City/Town	■ Almost all cities and towns in Arizona contract their mobile radio system maintenance to private industry, except some of the very large ones like Phoenix ■ A number of areas within the State of Arizona lack qualified maintenance personnel for mobile radio repair ■ The support of hardware and software for EF Johnson systems is poor
Fire District	■ In general, mobile radio system maintenance is contracted to private industry ■ Maintenance includes only the repair of failures and does not include preventative maintenance
Tribal Nation	■ Contract to private industry for mobile radio system maintenance ■ Maintenance is only considered necessary when there is a failure, and no preventative maintenance is carried out
Federal	■ Most federal systems are self-maintained or maintained under a federal maintenance contract with Motorola

Appendix D — Referenced Documents

The State has expended much effort in analyzing the public safety interoperability problems that have produced a number of valuable documents that fed the creation of the ConOps document. In a sense, the ConOps distills and augments the information created to date into a single document that can be distributed to all appropriate audiences. The additional analysis and material, added to the previous information, creates a compelling message of where the State is and where it needs to go to effectively address the critical issue of interoperability.

The documents that were referenced during the creation of the ConOps document are listed in the table below.

Table 17. Documents Referenced for Creation of ConOps

Document Name
Arizona Educational Outreach Strategy
Arizona Public Safety Wireless Communications ConOps Documentation
ADEMA Radio Interoperability Report
Civic Forums Fact Sheet
Consensus Statement from Arizona Emergency Medical Services (EMS) Associations
Elected and Appointed Fact Sheet
Federal Agency Fact Sheet
Macro Corporation Statewide Interoperability Needs Assessment (and supporting links)
Phoenix Fire Radio Report
PSCC Charter/General Policies
Public Safety Associations Fact Sheet
Public Safety Communications Commission Legislation Documentation/Senate Fact Sheet
Public Safety Fact Sheet
RCC Radio Interoperability Report

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